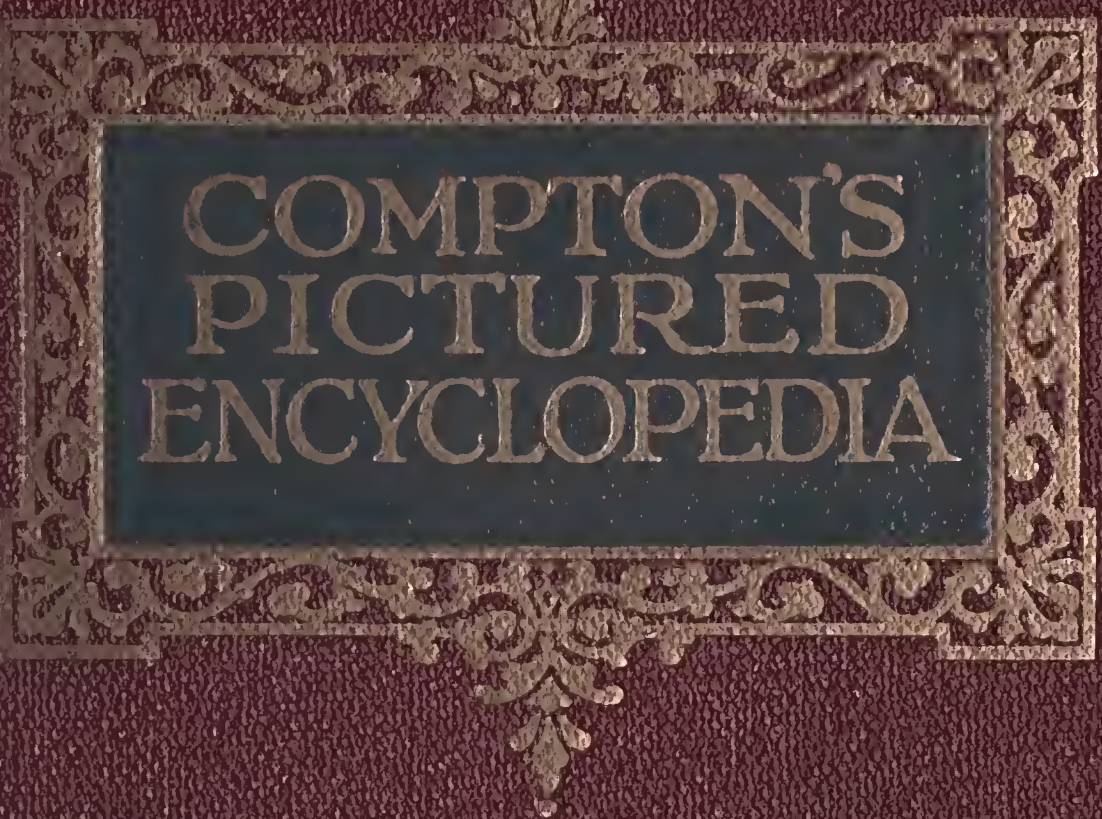

COMPTON'S PICTURED ENCYCLOPEDIA

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Hilda Hanway

Purity

YOU are looking out into the world, as Galahad did; you have something to find, as Galahad had. Galahad succeeded where others failed, and his secret is ours. He sought the highest end by the noblest means. He gave his utmost for the best. He kept the great end in view. He set an ideal before him, and followed it with the devotion of a friend for a friend. Nothing small or mean could swerve him from his path. He put first things first; he did not sacrifice a great end for small considerations.

And, whatever you do in the world, believe that there is no surer way to success than this. . . . Set a great purpose before you. Follow it to the end. Let nothing mean or selfish or ignoble enter into your soul. . . . Be a Galahad.

(See page 2938)

PURITY

Reproduced from the famous painting 'Sir Galahad' by George Frederick Watts

COMPTON'S PICTURED ENCYCLOPEDIA

VOLUME 6

To inspire ambition, to stimulate the imagination, to provide the inquiring mind with accurate information told in an interesting style, and thus lead into broader fields of knowledge — such is the purpose of this work

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HERE AND THERE in Volume Six

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. Divided as it is into broad groups, it offers a fascinating variety of subjects for selection. With this as a guide, you may wander through storyland, visit far-away countries, meet famous people of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list contains, however, only a small proportion of the articles in this one volume, and is not intended to serve as a table of contents, an index, or a study-guide. For these purposes consult the Fact-Index and the Study Outlines in Volume Eight.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index in the last volume. Marked letters are sounded as in the following words: *cāpe, ăt, fär, fȧst, swạt, fa̤ll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, nŏt, fôr, wȯn, do̤; cūre, bŭt, düne* (French *u*), *rṳde, fụll, bûrn; g̃o, ġem, cañyon, Jeaṅ,* (nasal); G = German *g* (guttural); K = German *ch* (guttural).

COMPTON'S PICTURED ENCYCLOPEDIA
VOL. 6

The MOTHER of PARLIAMENTS By the Thames' Side

PARLIAMENT. For more than 600 years the English Parliament has been making laws for that kingdom, and more lately for the British Empire. It is the oldest legislative assembly in existence, and from it, directly or indirectly, have been derived all the legislative bodies now in the world. So it is with reason that it is called "the Mother of Parliaments." Many of its ceremonies date back to the time of Henry VII and Henry VIII, at the dawn of modern history. The foundations for some of its rules are found in its journals in Elizabeth's reign. Its division into the two houses—House of Lords and House of Commons—took place in the middle of the 14th century, 150 years before Columbus discovered America. And Westminster Hall, where some of the earliest parliaments sat and which is now the vestibule to the Parliament Building, is a relic of the palace of King William II, begun in 1097.

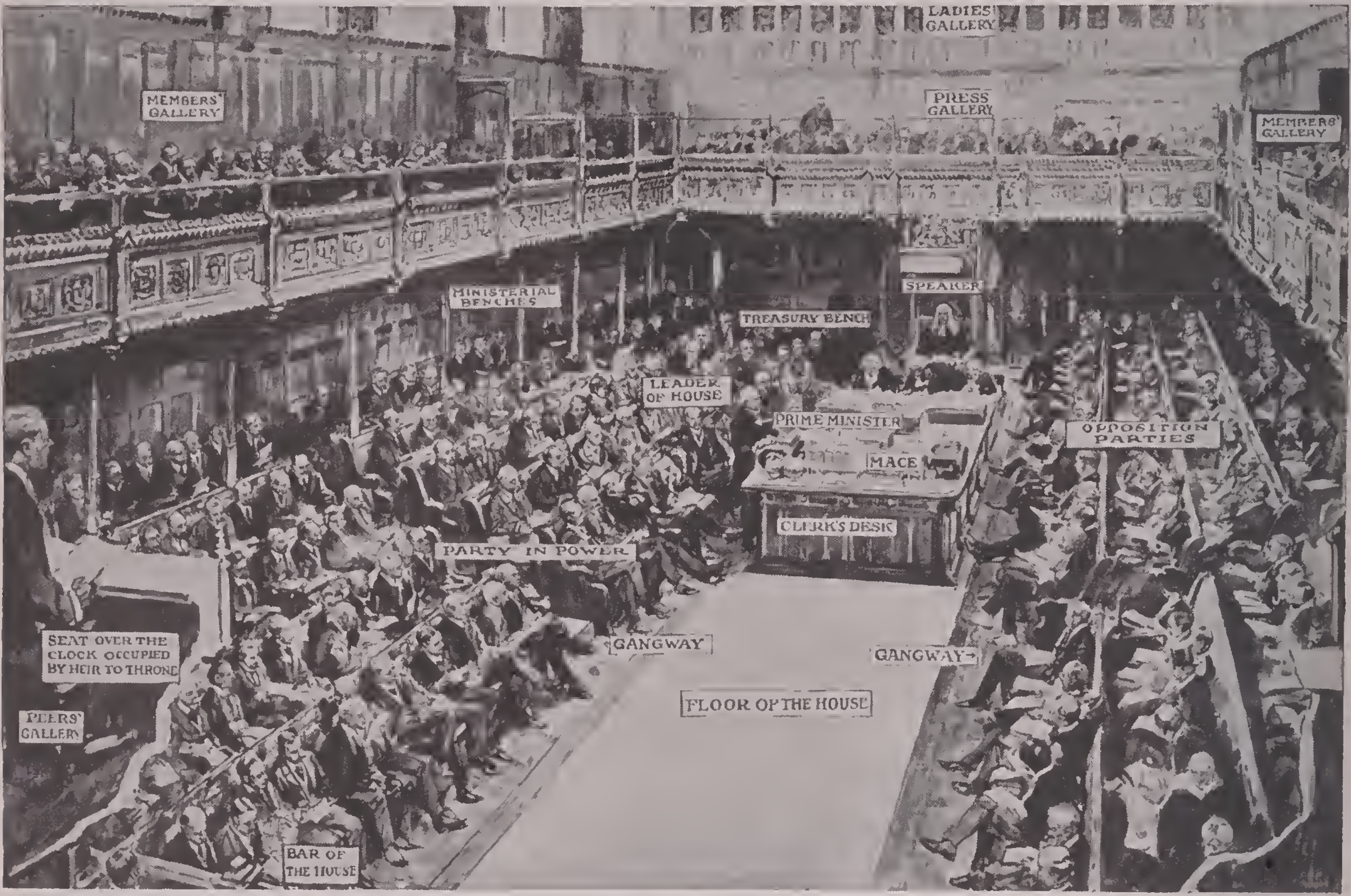
There never has been a time since England has been united into a single kingdom when some sort of assembly did not aid the king in governing. In Anglo-Saxon days this body was called the "Witenagemot," or assembly of "wise men," and it was made up of bishops and abbots, king's thegns, and chief officers of the kingdom. After the Norman conquest the kings called together their "Great Council," composed of feudal lords who held land directly from the king. These persons all sat in the assembly "in their own right," by virtue of their lands or offices. It was not until the 13th century that *elected* representatives were added to the assembly, and it is this representative character which chiefly makes the difference between the feudal Great Council and the modern Parliament.

In 1265, for the first time, representatives of the "knights of the shire" or counties, and of the "boroughs" or towns, were both asked to meet with the Great Council. This first Parliament was called by Simon de Montfort (*see* Montfort, Simon de) in the time of the Barons' Wars against the king. But in 1295 Edward I himself called an assembly which established it as a rule that in a Parliament there ought to be representatives of the counties and the towns along with the lords. This was called the "Model Parliament," because it became a model for succeeding bodies in England.

At first the representatives of the counties and towns sat in the same body with the barons and great churchmen; but by the year 1340 the Parliament had separated into two "houses." The Upper House became the hereditary House of Lords, and included the great barons (who now bear the titles of duke, marquis, viscount, and baron) and also the archbishops and bishops, and the abbots or heads of monasteries. Since the religious Reformation the abbots have disappeared from Parliament, and the number of bishops who sit in that body has been limited.

The Lower House became the elective House of Commons, and in course of time it grew into the most important part of Parliament. This was because it was called upon especially to vote the taxes which the

THE HOUSE OF COMMONS IN SESSION



The Prime Minister and his associates in the government sit on the front benches at the Speaker's right. Members who wish to address the House rise in their places, and wait for recognition from the Speaker. Members who rise to speak must remove their hats, but otherwise they may keep their heads covered if they wish. Because the Ministers are busy most of the day with the affairs of their departments, the important sessions of the House are usually at night, and often continue far into the morning.

king needed for carrying on the government. In time it became an established rule that all bills dealing with money must start in the House of Commons, then the right of the Lords to amend money bills was lost, and in 1911 a law was passed that such a bill could not even be rejected by the House of Lords. The House of Commons thus has supreme authority in raising and appropriating money.

For more than a hundred years after the time of Charles II (1660–1685) there was almost no change in the places represented in the House of Commons, and so grave abuses arose. Many of the members represented what were known as "rotten boroughs," that is, towns which had so declined in population that they were no longer important. Some places which sent representatives in the early 19th century were mere mounds and ditches, without any inhabitants, or were towns which years before had been swallowed up by the sea. Sometimes these places were called "pocket boroughs," because the lord of the land practically named the members himself—carried them about "in his pocket," so to speak. Often such seats in Parliament were almost openly bought and sold. On the other hand many of the great manufacturing towns, which had sprung up as a result of the Industrial Revolution, had no separate representatives in Parliament apart from the two representatives given to every county or shire. There were also great complaints arising out of the restrictions and inequalities in the right to vote for members of Parliament.

The first general reform of these abuses was in the great Reform Bill of 1832. By its provisions many of the small boroughs lost all or part of their representatives in Parliament, while the great manufacturing towns gained representation. At the same time the "franchise," or right to vote, was made more liberal, so that small landholders in the counties secured the vote, and the franchise in the towns was made uniform. Later laws, passed in 1867 and in 1884–85, further reformed the House of Commons by giving more people the right to vote and giving representatives to additional towns and districts. Then in 1918 a law was passed giving women over 30 years of age the franchise, so that today the Commons is as representative as any legislative assembly in the world.

The hereditary House of Lords has also been reformed, but the reformation of it has meant the loss of its power to block legislation which the people demanded. Since 1911 any money bill passed by the House of Commons becomes a law without the assent of the House of Lords; and any other bill that is passed by three successive sessions of the House of Commons may become a law, even if the House of Lords refuses to pass it.

In the House of Lords today there are about 700 members, including 28 Irish peers elected by the nobility of Ireland for life, and 16 Scottish peers elected by the nobles of Scotland for the duration of Parliament. In this House still sit the archbishops of Canterbury and York, 24 bishops, and certain "law lords" who are appointed because of their legal ability and take part in the work of the House of Lords as a supreme court.

The House of Commons consists of members representing the counties, the towns, and the universities. There are 707 members in this House, elected for the duration of Parliament, which cannot now be longer than five years; it may, of course, be shorter if the assembly is dissolved by the advice of the prime minister. The chief leaders of the party which has the majority in the House of Commons, together with the leaders of that party in the House of Lords, make up the Cabinet, which guides the business of Parliament and at the same time forms the responsible executive of the country (*see* Cabinet).

The King's Veto Power Only Nominal

The acts of Parliament must be approved by the crown, which in theory has the right of veto; but as the royal assent has not been withheld from an act of legislation since the time of Queen Anne—more than 200 years ago—we may say that the right of royal veto has in practice disappeared in Great Britain.

In the hundreds of years that Parliaments have been meeting, some sessions have gained special fame and a special name. There was the Model Parliament of 1295 mentioned above. The Long Parliament summoned by Charles I in 1640 lasted legally until 1660, though during the time of the Protectorate it was not in session. After the army had driven out some of the members of this Parliament in 1648 the remnant was scornfully called the "Rump." In 1653 Oliver Cromwell called together an assembly which his enemies called "Barebone's Parliament" because one of its members was named Praise-God Barebone. The Cavalier or Drunken Parliament of Charles II, also called the Long Parliament of the Restoration, lasted from 1661 to 1679.

Scotland ceased to have a Parliament of its own and began sending members to the Parliament at Westminster (London) when Scotland was joined with England, in 1707, in the kingdom of Great Britain.

Ireland had its separate Parliament until 1801, when it too was merged in the Parliament of Great Britain. The Home Rule movement, which began in 1870 and to which Charles Stewart Parnell gave his life, sought to restore the Irish Parliament with or without the withdrawal of the Irish members from Westminster (*see* Ireland).

PARNELL', CHARLES STEWART (1846–1891). This greatest of modern Irish leaders was largely of English and American ancestry, was a landlord and a Protestant, and had nothing of the traditional Celtic Irish temperament. But hatred of England and the English early became a ruling motive of his life.

Asked in 1874, "Why don't you go into Parliament?" Parnell answered at once, "I will; whom ought I to see?" The Home Rulers, who were then just beginning to make themselves a factor in politics, offered him a nomination. He was in many ways unsuited to political life. Ignorant of Irish history and knowing less about Irish politics, he found it also difficult to express what he did know. It is not surprising that he was beaten in his first effort. "Well, boys," he said, "I am beaten, but they are not done with me yet." A year later he carried the Meath election and entered the House of Commons.

The organized Home Rule movement was then only five years old. Six years earlier the English church in Ireland had been deprived of its privileged position as an established church in a country chiefly Roman Catholic (*see* Ireland). Only five years before Gladstone had first taken up the vexed question of tenants' rights in the land they rented, and passed the Land Act of 1870, which improved the position of tenants by giving them compensation for improvements. There was still much to do. Irish land rents were high, and were paid usually to landlords who lived in England and who had little interest in their tenants. Further, the Irish people wished self-government. In the glorious days of 1782 to 1798, an Irish Parliament had played a historic rôle. They could not forget that parliament, nor could they forget old bitternesses against England. Many "Fenians"—as they called themselves—demanded nothing less than independence, and engaged in numerous plots against the British government.

The former leader of the Home Rule party hoped by conciliatory methods to win English support for the cause. Parnell, as a member of Parliament at Westminster, played a very difficult rôle. He showed no regard for English public opinion, he spoke with the most biting scorn, and began a policy of obstruction and delay in Parliament. He did it all quietly and showed little concern at the bitter antagonism he roused. This policy made him a hero in Ireland and served to unite behind him both Home Rulers and Fenians. In 1877 he became the Irish leader.

The "Boycott" Policy

In 1880 the Liberal Party introduced a land bill to relieve the tenants who, because of famine, could not pay their rents. That bill failed and the landlords again set out to drive the tenantry from their holdings. Under Parnell's inspiration a policy of "boycott" was adopted all over Ireland (*see* Boycott). Landlords who had evicted their starving tenantry found they could not re-rent their lands. But the method did not cure the real distress of the peasantry. A Land League was formed which soon had 200 branches in Ireland. Then the government adopted "coercion" and Parnell answered by "obstruction." The government introduced another land bill under which fair and stable rents were to be fixed by tribunals and tenants were given the right to sell the good-will of their holdings. Parnell was not grateful when this became law (1881). Neither he nor his followers voted for the bill. It did not go far enough to suit him, and he did not discourage the peasantry when they refused to make use of the bill.

Parnell was arrested and put in Kilmainham jail. Asked by his supporters who would take his place, he replied, "Captain Moonlight." He proved right, for once more disorders moved the English government to concessions. Gladstone made an informal bargain with Parnell (Kilmainham Treaty) by which disorders in Ireland were to stop and Gladstone would introduce a Home Rule Bill. Parnell left prison, disorders almost ceased, and all looked well for Home Rule. Unhappily for Ireland, the chief secretary of Ireland and the under-secretary were both murdered in Phoenix Park (Dublin). The murder shocked Britain and spoiled Parnell's victory. Once more the government resorted to coercion. Gladstone indeed brought in a Home Rule Bill in 1886, but opinion was running against the Irish and Gladstone failed to pass his measure. The Liberal Party upon which Parnell had relied split apart and went out of office (*see* Gladstone). Fire and murder followed in Ireland, and the government resorted again to coercion.

Parnell is Falsely Accused

In 1887 the *London Times* brought out a series of articles accusing Parnell of aiding and encouraging the policy of crime in Ireland. They even printed a facsimile letter in which Parnell approved the Phoenix Park murders. Parnell denied that the letter was genuine, and the matter was tried before a judicial commission. It turned out that a rascal named Pigott had forged the letter and sold it to the *Times.*

The outcome increased Parnell's prestige. He was lionized by London society, was petted by the Liberal Party, and stood close to Gladstone. It seemed probable that as soon as the Liberals were returned to power Parnell would accomplish his life aim.

Before this came to pass Captain O'Shea, one of Parnell's party lieutenants, sued his wife for divorce, naming Parnell. The divorce was granted and Parnell soon married Mrs. O'Shea. The Irish party upheld Parnell, but there was a storm in England. Gladstone was made to see that if he stood by Parnell he could not hold the English Nonconformist vote, and hence refused to deal with Parnell as the Irish leader. The Irish party then threw over Parnell. Parnell refused to resign and fought to the end. His death from pneumonia, which occurred three months after his marriage, left the Irish party under divided leadership, and postponed for many years any effective renewal of the fight for Ireland's cause.

PARROTS, MACAWS, AND COCKATOOS. Polly does *not* want a cracker! She would much rather have a rose or a peanut, for these brilliantly feathered birds prefer to dine on flowers, fruit, or nuts. Including the macaws and cockatoos with the parrots, to whom they are closely related, there are about 560 species of these gorgeous birds. They inhabit South America, Africa, the East Indies, Australia, and New Zealand. All are characterized by the large arched upper beak, and by the position of the toes, two of which point forward and two backward. These birds all have a harsh screaming voice, but some have the power of imitation and can be taught to speak a limited number of words quite plainly.

They are clumsy walkers, but good climbers and strong fliers. The birds mate for life. They build in hollow trees or occasionally in sandbars. Parrots, especially, endure cage life well, and in spite of the habit of biting are favorite pets. They are long-lived, some reaching the age of 70 years.

The gray parrot of western Africa is most easily taught to speak. It is less showy than the other varieties, having quiet gray plumage flushed with red.

One hundred and ninety species of parrots are found in the New World, only one of which occurs north of the southern border of the United States. This is the Carolina parrakeet, a bird about 13 inches long, having a green plumaged body and yellow head.

The forests of South America, especially, abound with these bright colored birds. The blunt-tailed parrot, a common parrot of the zoölogical gardens, is a native of the Orinoco territory. It is a bright green color with blue on the head and markings of red or yellow on throat and wings.

The macaws are a long-tailed group of larger parrots, numbering about 15 species, found most abundantly in Paraguay and Brazil. The macaws are the most gorgeously colored members of the parrot group, the red and blue being one of the handsomest.

The Screaming Cockatoos

The cockatoos, found in the Australian regions, are similar to the parrots in habit. They thrive well in captivity and may be taught a few words, but are more apt to use their voices in screaming. The plumage of the cockatoo is generally white tinged with red, orange, and other colors. Most species have a large crest of feathers that can be raised to a height of as much as five inches, but which lies smooth when the bird is quiet. These birds fly about in flocks of 100 to 1,000 and are very destructive to grain fields.

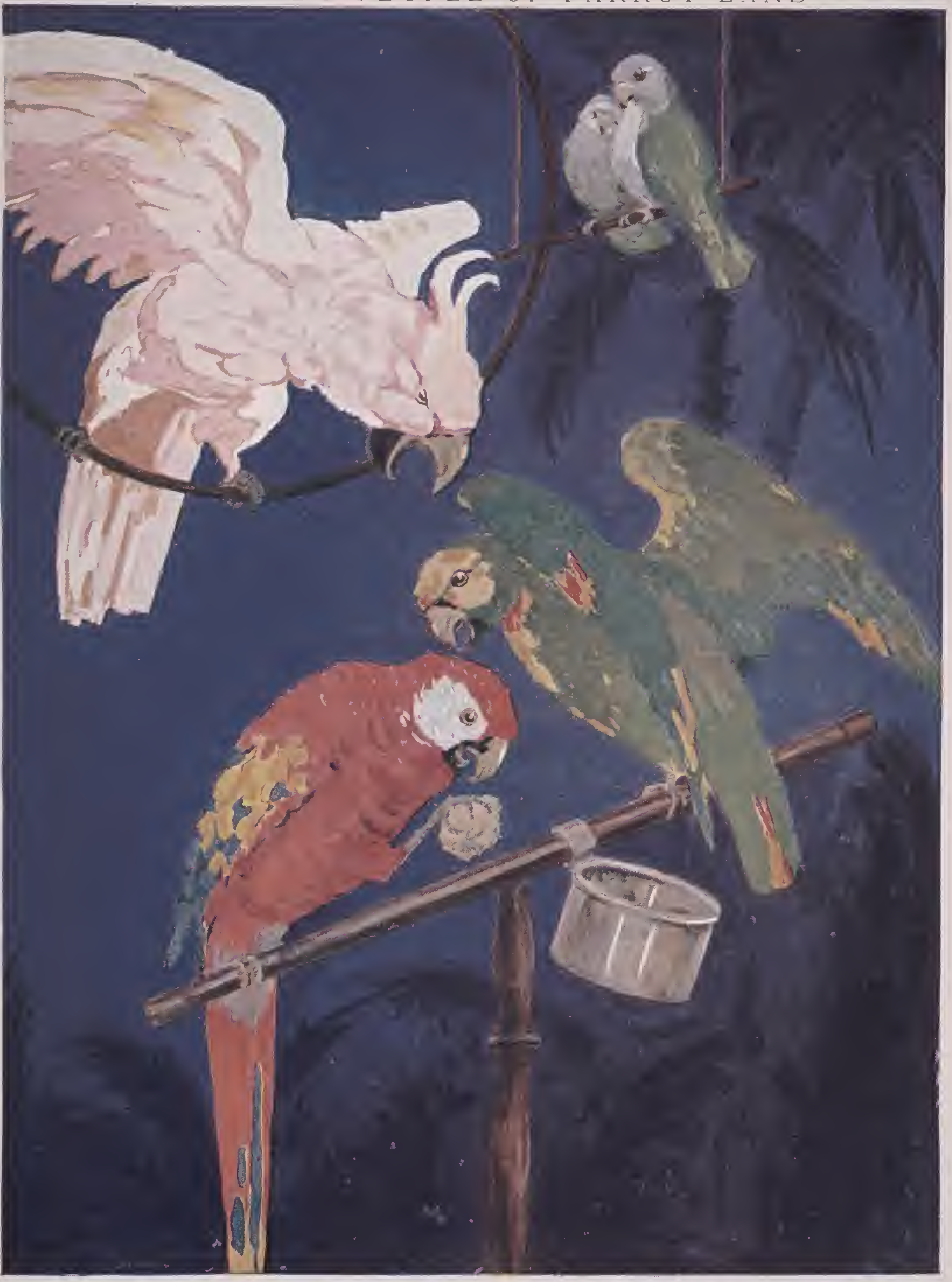
The lory is a species of parrot remarkable for its peculiar extensible tongue with which it takes the nectar of flowers.

In New Zealand occurs the kea, an olive-green parrot which has fallen from its fruit-eating habits to attacking and killing living sheep, thrusting its powerful beak into the fat which surrounds the kidneys.

Love-birds are tiny African parrots, no larger than sparrows, but of pretty colors. They receive their name from the affection which they show to each other. They are frequently kept as cage-birds.

Parrots belong to the order *Psittaci.* Scientific name of gray parrot, *Psittacus erithacus;* of Carolina parrakeet, *Conuropsis carolinensis;* of blunt-tailed parrot, *Chrysotis amazonicus.* The macaw is of the genus *Ara.* Scientific name of red and blue macaw, *Ara macao.* The cockatoo is of the genus *Cacatua.* Scientific name of sulphur-crested cockatoo, *Cacatua sulphurea;* of funeral cockatoo, *Calyptorhynchus funereus.*

THE GAUDY PEOPLE OF PARROT LAND



You know, perhaps, how Nature so often distributes her favors piecemeal; how sweet-singing birds usually wear dull feathers, while gorgeous colors so frequently go with harsh voices. The Bird of Paradise, for instance, has a cry as ugly as its plumage is beautiful. Well, the Parrot people are even better examples of this rule. If you've ever been in the parrot houses at a "zoo" when its short-tempered inmates were voicing their troubles, you don't need to be told how frightful is their native language. As if to make up for it, almost all the colors in Nature's paint-box have been applied to one or the other of the many species. Here we have a Red Macaw, a Green Amazon Parrot, a Rose Cockatoo, and two little Love-Birds, about all of whom you may read more on the back of this picture, as well as in the article on Parrots.

DRESS AND MANNERS OF PARROT PEOPLE

WHAT an amazing variety of fashions we find among the Parrots! Even between close relatives colors and style of dress will differ sharply. Cockatoos of the kind that are usually kept as pets look like the one in the picture on the other side of the page—a delicate white and rose. "He's a little pink cloud with wings!" said a little girl once upon a time, when she caught sight of one of these fluttering in a high cage. But other Cockatoos wear red and gray and black and brown. The largest of the family, and one of the biggest of the whole Parrot tribe, is the great Black Cockatoo, of New Guinea. And among the pink Cockatoos there is a difference of taste about head-dress; that is, they are divided into two main groups, according to crest. Some, like the one in the picture, wear slender feather crests, which curve forward and end in sharp points, while others wear broad feathers with rounded tips, which do not curve forward.

The Macaws are known for their large size, gorgeous dresses of blue, red, and yellow, and their long tails. See what a tail ours has. He can't quite get it all on the page!

On the perch with the Macaw is the familiar Amazon or Green Parrot, the best known of all the Parrot people. The tails of the Green Parrots are usually about half the length of the wing, and may be either squared or rounded at the end.

Of the Love Birds, the scientific people say that their domestic relations are not always as ideal as is popularly supposed. One learned ornithologist says of a pair he keeps that the Lady of the House is a perfect little tyrant! If her devoted spouse doesn't sit close when she wants him to, she scolds him like everything, but at other times she drives him away.

PARSNIPS. The parsnip (*Pastinaca sativa*) is a hardy biennial plant—that is, it forms its fleshy carrot-shaped root the first year, but does not produce any seed until the second summer; then the plant, springing up quickly from the root, sends a branching stem up among the leaves, topped with many greenish-white little flowers. The root, which is eaten the first season, is thick and whitish and has a peculiar but agreeable flavor, sweet but slightly acrid. The root often grows to a length of 18 inches and a diameter of 3 or 4 inches at the crown. Besides being cultivated as a vegetable the parsnip is highly valued as a food for live stock, particularly in Europe. The roots usually are left in the ground in the autumn, as they are improved by the frost; when stored they soon shrivel and become tough unless they are kept moist.

In Europe the plant has been cultivated since the time of the Romans. A wild form of parsnip without the thickened edible root still grows as a troublesome weed in waste places of Europe, the United States, and Canada.

PASSION FLOWER. When the Spanish settlers were roaming through South and Central America they found a flower so symbolic of the Crucifixion that they named it the "flower of the Passion." In the five-parted purple or lavender blossoms with stripes of white they saw the crown of thorns and the five marks of the wounds of Our Lord. The styles were the three nails and the stamens were the hammer that drove the nails into his hands and feet. The floral leaves were the ten apostles, Judas and Peter being absent, the one having betrayed and the other denied his master. The leaves were the hands of the persecutors and the clinging tendrils the scourges.

The plant of the North American passion flower is shrubby and climbing, being somewhat troublesome in the southern cotton fields. Some of the South American species are cultivated for the pale yellow berries, of the size of a small apple. The root of some species is poisonous and acts like morphine. Other species are planted that they may crawl and twist over our arbors and verandas.

The Passion Flower or common Maypop of the Southern states.

Scientific name of common passion flower of the Southern states, *Passiflora incarnata.* Flowers solitary, white or purple, 2 inches across, with 3 bracts beneath the flower; 5-part calyx colored like petals; 5 sepals with which is a crown of numerous rays forming a fringe; 5 stamens; 3 styles and capitate stigmas; leaves alternate, 3-lobed, cordate-ovate, serrate; stem trailing or climbing by tendrils.

PASSOVER. With tears and rejoicing, with song and praise, the Jews through many centuries have celebrated the festival of freedom, which commemorates their deliverance from Egypt. Round the festal board on the eve of the Passover, the family gather to rejoice and thank God for his preservation of their race.

The father of the family sits at the head of the table, which is spread with the best linen and adorned with the best of the family plate. Before him are symbols such as have been used since ancient times to explain the story of the Passover. First of all, there are three flat loaves of *matzoth*, or unleavened bread. This is a reminder of the haste with which the Israelites were forced to leave Egypt; they had no time to make provision for the journey or to allow their bread to rise, but had to carry the unleavened dough with them and bake it on the way. A roasted lamb bone and a roasted egg commemorate the burnt-offering which the Hebrews were commanded to offer, when God promised to pass over their houses and spare their first-born. Another dish contains a portion of horse-radish or other bitter herb, used to represent the bitter life of the Israelites in Egypt; and a paste of nuts, apples, and spices, made to resemble clay or mortar used in building, is a sign of the heavy toil exacted by the Egyptians.

These symbolical dishes are tasted at stated times, while the father reads from the Talmud legends of the forefathers, miraculous stories, prayers, and songs, in which the rest of the family often join.

It is the custom of the youngest child in the family to ask questions about the meaning of the celebration, and these are answered by the father. The whole ceremony is designed to appeal especially to the young, not only in its serious side, but in the games, songs, and stories that make the time pass merrily.

The Jewish Passover falls in the early spring, about the same time as the Christian Easter. The Last Supper of Christ and his disciples was the opening feast of the Passover. The date of the Passover is not determined in the same way as that of Easter, however; hence they do not always come together. Passover begins on the 14th of the Jewish month of Nisan, and lasts till the 21st. Only unleavened bread is eaten during the week and the first and last days are kept as holy days. The Orthodox Jews keep eight days instead of seven, observing the first two and the last two days as holy days.

PASSPORT. Are you planning to travel in foreign countries? If so do not forget to obtain a passport from your government, for since the beginning of the World War such certificates of citizenship are far more necessary than formerly. Into countries disturbed by war travelers without passports are not admitted at all, and in any country they may prove of great assistance.

Passports in the United States are issued by the Department of State at Washington to native or naturalized citizens. Each contains a description of the person to whom it is issued, together with a photograph. It thus establishes the identity of the traveler, and it recommends him to the protection of the authorities of the countries which he visits. It must usually be "viséd" or countersigned by the officials of each country in which it is presented. A citizen is not entitled to a passport as a matter of right, and the State Department may decline to issue one to certain individuals and for certain purposes. Passports are for limited periods—two years in the case of the United States—but may be renewed.

In some European states no citizen is allowed to leave the country without first securing a passport. This agrees with the etymology of the word (from French *passer*, "to pass," and *port*, a "port" or "harbor"), which means literally to enter or leave a port or harbor.

PASTEUR (*päs-tûr'*), LOUIS (1822–1895). On the afternoon of July 2, 1881, a group composed of French officials, eminent scientists, delegates from medical societies, Parisian journalists, and a scattering of farmers waited expectantly in a farmyard in the little village of Peuilly-le-Fort. A few members of the party were inspecting a row of dead sheep which occupied one side of the enclosure. The others watched the roadway. Presently one of these called out: "Here he comes!" and the entire group broke into a wild cheer as a small bearded man appeared in the gateway. He bowed, then advanced toward the sheep carcasses. He counted them—25.

"Where are the others?" he asked quickly.

Someone pointed to a nearby pen filled with living sheep. The bearded man counted again—25. Then he turned to the assemblage with a simple gesture and said: "You see, gentlemen."

It was a moment of triumph for one of the greatest of men—Louis Pasteur, world-famous chemist. Some months before he had announced that sheep and cattle could be protected from the deadly disease of anthrax —the germ of which was discovered by Koch five years before—by first injecting into their blood some of the weakened germs of the disease itself. The bodies of these animals, he said, would in this way develop such a power of resistance against anthrax that it could obtain no hold upon them. His statement met with ridicule. "Prove it," said the veterinarians. Pasteur accepted the challenge. Fifty sheep were placed at his disposal. He vaccinated 25 of them, the others were left in their natural state. Some days later, the entire 50 were inoculated with powerful cultures of living anthrax germs.

"The 25 vaccinated sheep will live," said Pasteur. "The others will die."

We have seen the result of the experiment. This was only one of the many great achievements of the man, whom the French people once named as the greatest of their national heroes, placing him, in their votes, ahead of Napoleon and Victor Hugo. He extended the method he had used in anthrax to the terrifying disease of rabies or hydrophobia. He succeeded in making animals immune to rabies germs, and finally saved the life of a boy who had been bitten by a mad dog, and who was the first person who ever escaped death under such circumstances. It was due to Pasteur's discoveries of the effects of bacteria in fermentation and decay that Lord Lister was able to devise the methods of antiseptic surgery. (*See* Antiseptics). Pasteur also discovered and overcame the germ which was killing the silkworms of France and threatening the entire silk industry. He devised the method of preserving the purity of milk called "pasteurizing." His work laid the foundation for the most of the great life-saving discoveries of the last 50 years in the field of germ diseases. The application of his discoveries in various fields of industry was said by Thomas H. Huxley, himself a great scientist, to have saved France the amount of the billion-dollar indemnity paid by France to Germany in 1890.

Pasteur was born at Dôle, Franche-Comté, where his father was a tanner. After many struggles, he entered the École Normale in Paris. Strangely enough, the graduating diploma of the boy who was to become the greatest chemist of his time was marked "mediocre" in chemistry, perhaps because Pasteur's school work was already distinguished by that independence and originality which contributed so much to his later success. His gospel was the "will to work" and he was never satisfied with tasks half done. In 1868 he was appointed professor of chemistry at the Sorbonne, and in 1888 he became director of the famous center of scientific research known today as the Pasteur Institute.

In pasteurizing milk or other liquids the object is to kill the bacteria which cause souring or may produce disease. This is done by heating the liquid to a temperature of 130° to 160° F. (preferably 140° to 145°) and maintaining that temperature for from 10 to 30 minutes. The heat is usually supplied by steam, and in milk-bottling establishments a continuous process is used by which the milk passes through the apparatus in a slow but continuous stream. Home pasteurizing apparatus for preparing milk for feeding babies can be bought at a relatively low price.

PATAGO'NIA. The southern part of the continent of South America, as far as the Straits of Magellan which separate it from the archipelago of Tierra del Fuego, has long been known as Patagonia. Since 1881 the land has been divided between Chile and Argentina. The Chilean section, to the west of the Andes, is a densely wooded strip only a few miles wide. The Argentine section extending 1,000 miles north to the Rio Negro is a tract of more than 300,000 square miles, nearly one-third of the area of the whole Argentine republic. Patagonia was discovered in 1520 by Ferdinand Magellan. It was then inhabited by a race of Indians remarkable for their great stature, but this race is today virtually extinct. (*See* Argentina; Chile; Magellan.)

PATENTS. "Yankee ingenuity" is a phrase that still characterizes the Americans. They are an inventive people. If anyone doubts it, let him go rummaging through the million and a quarter inventions in Uncle Sam's Patent Office at Washington. An examining corps of almost 400 is not enough

PASTEUR AT WORK IN HIS LABORATORY

"There is no greater charm for the investigator," said Louis Pasteur, "than to make new discoveries; but his pleasure is heightened when he sees that they have a direct application to practical life." Pasteur's discovery of bacteria as the cause of fermentation and decay, and of antitoxins for anthrax and hydrophobia, alone place him in the front rank of scientists.

contained in the Easy Reference Fact-Index at the end of this work to cope with the steadily increasing deluge of applications that come flooding in—an average of over 200 a day, or more than 70,000 a year. Yet about 100 years ago an employee in the Patent Office resigned, saying that since inventions had been practically all made and the office must therefore go out of existence in a year or two, he thought it wise to secure a position elsewhere!

This office is one of the oldest branches of the Federal government, having been provided for in the Constitution itself. In 1790 Congress created the first patent commission, which had to wait three months before an applicant appeared. He was Samuel Hopkins, and he had invented a new process for making pot- and pearl-ashes. Today the United States leads the world in the number of its patented articles, having more than one-third of all the patents issued by the civilized nations of the earth, and more than twice as many as its nearest competitor, France.

Some Weird Inventions

Naturally not all of the million and a quarter patents represent valuable inventions. One patented device is designed to enable a man buried alive to signal to people outside. Another attempts to render trains collision-proof by means of rails running over the roof so that one train overtaking another would run over the top instead of colliding with it. Hundreds of men and women have clung to the impossible dream of inventing perpetual motion, but since none of them were ever able to furnish a working model, their applications were never granted.

When we compare countries as to the success and importance of their inventions, the result is the same —the United States easily takes the first place. No one has ever labored so hard to save labor as has the American. The greatest of all labor-saving devices, the sewing machine, is chiefly his, and outside of the textile industry (in which England is preëminent) practically all of the great advances in labor-saving machinery have been of his invention—the cotton gin, the reaper, shoe machinery, the typewriter, and typesetting machines. The three most signal advances in electrical application are also to his credit—the telegraph, the telephone, and the incandescent lamp—and the Patent Office contains also a model of Wright's first airplane.

A Standard for all the World

The institution of the American Patent System, established in 1836, created a revolution in the method of granting patents and became the standard for the whole world to emulate. It provided that patents should be issued only after a thorough examination into the usefulness and novelty of the inventions, thus avoiding endless duplication and lawsuits. Greater emphasis was placed upon the right of the inventor to have this invention rewarded, and relatively less upon the benefit which the public would derive from it. Experience has showed that no reward was so fitted to the achievement and so productive of the common welfare as to allow an inventor a monopoly of his invention for a limited time. In 1836 the erection of the Patent Office was begun, and in a short time American inventions increased by leaps and bounds.

The inventor who wants a patent must submit to the Patent Office a written description and drawings of his invention, together with special claims for it, and an application fee. He must also declare upon oath that he believes the invention to be an original one. A search is then made by the examiners at the Patent Office to see whether the idea is really new. If it is so judged, the patent is issued on payment of an additional fee, and the inventor then has the sole right to make and market the invention for 17 years. If anyone infringes upon his rights—that is, makes or sells his patented article—he can compel the infringer to desist and make restitution by bringing suit. Patented articles must always be marked "patented," with the date of issue or serial number.

By an international agreement among all the principal countries except Russia and Canada (a total of 27), the citizens of each are able to enjoy in all others the advantages that their laws accord. During war time, however, patent rights of enemy countries are not recognized. In 1918 the United States released to American factories 20,000 German patents. (*See also* Inventions.)

PATERSON, N. J. As the principal silk-manufacturing center of the Western Hemisphere, Paterson is often called the "Lyons of America." It is the third city of population in New Jersey, and only a little more than eight square miles in extent; yet the value of the silk it produced in a single year has reached the enormous amount of $200,000,000.

Paterson owes its origin largely to the activities of Alexander Hamilton, who believed that the United States should be independent of Europe and manufacture all the textiles needed for its own use. Sixteen miles northwest of New York, where the water of the Passaic River drops over a precipice 70 feet high and furnishes abundant power, he selected the site for a company to promote textile manufactures, and as early as 1791 the city of Paterson was founded.

Although a great industrial city, Paterson has a brighter aspect than the ordinary manufacturing center. This is due to the fact that very little soft coal is used because of the necessity of keeping the silk fabric clean while in process of making. This cleanliness is reflected in the city's death rate, which is one of the lowest of the large cities of the country.

The manufacture of metal products, including locomotive, airplane and electric motors, and textile and other machinery is second in importance to silk. Other manufactures include shirts, twine, thread, and the dyeing of silk and cotton. Population of Paterson, about 136,000.

PATRICK, SAINT (389?–461). You all know March 17, when St. Patrick's Day, the day of the patron saint of Ireland, comes. But did you know that Patrick was born in what is now England? He lived in southwestern Britain in the troubled days when the Romans were abandoning the island to its fate, and before the English had appeared, and was educated as a Christian. Then one day, when he was 16 years old, some wild Irish raiders came that way and took him as a slave, carrying him away to Ireland.

After he had served in Ireland for six years as a wineherd, he managed one day to escape in a ship that was going to Gaul (France). For a time he lived in Gaul where he became a monk, and then returned to his home in Britain.

After his return he dreamed one night that a man came to him with a paper bearing these words, "The Voice of the Irish," and at the same time he heard the Irish calling, "We pray thee, holy youth, to come and walk again amongst us as before."

This Patrick decided was a missionary call to Ireland. He returned to Gaul, where he spent 14 years in preparing for his work. He arrived in Ireland with the title of bishop and the pope's blessing, and began the work which was to make him the patron saint of the island.

It has been said that there "were no Christians in Ireland when Patrick began his work and no pagans when he died." This is not strictly true, but he did much to establish Christianity firmly in the island, building churches and monasteries and converting the people. And he did this work while fierce tribal chieftains ruled the land, and there was only a semblance of settled order.

Many legends grew up in Ireland about St. Patrick. You know, perhaps, the story of how he compelled the snakes of Ireland to fling themselves into the sea. There is another story to the effect that when some converts questioned the doctrine of the Trinity, St. Patrick ended the argument by holding up a shamrock leaf, as an example of "Three in One." It was claimed that at his death, on March 17, 461, there was no night for 12 days.

PATRIOTIC SOCIETIES, UNITED STATES Many societies have been formed in the United States to keep alive the memory of its heroic past and to cultivate the sentiment of patriotism in the youths of today. The earliest of these was the Society of the Cincinnati, organized by Gen. George Washington and his officers, May 10, 1783, at the cantonment of the American army on the Hudson River, New York. American and French officers formed the society to keep alive the memory of their comradeship in arms and to perpetuate remembrance of their turning, like Cincinnatus of old, from war to peace when their task was done. Membership goes to the eldest male descendant if worthy; if there is no male descendant, then to male descendants through the intervening female line. Until his death General Washington was president-general, and then Alexander Hamilton succeeded him. There are about 890 members at the present time. The city of Cincinnati was named after this society.

The Sons of the Revolution was formed in 1875, and the Sons of the American Revolution in 1889; the Daughters of the American Revolution in 1890, and the Daughters of the Revolution in 1891. The object of all four societies is to perpetuate the memory of ancestors who helped achieve American independence. In addition there are the Society of Mayflower Descendants, the Society of Colonial Wars, the Colonial Dames, the Society of the War of 1812, and a number of other organizations to commemorate events in the country's early history. The Naval Order of the United States, organized in 1890, admits to membership naval officers or their male descendants, or enlisted men who received the Naval Medal of Honor for gallantry.

After the Civil War a number of veteran and commemorative societies were organized. One of the first of these was the Military Order of the Loyal Legion, which was composed exclusively of officers or of the oldest sons of living officers. Among the other Civil War organizations are the Grand Army of the Republic, the United Confederate Veterans, the Sons of Veterans, Daughters of the G.A.R., Daughters of the Confederacy, etc. Of these the largest and most important is the Grand Army of the Republic (G.A.R.), composed of Civil War veterans; at its height in 1890, the membership numbered 409,489, but year by year the number is fast being reduced by death. Affiliated with the G.A.R. is the Woman's Relief Corps, founded in Denver in 1883 by women relatives of soldiers of the Civil War, its aim being to perpetuate the memory of dead soldiers and to care for their dependents. Like the G.A.R., it is divided into 30 or 40 departments.

The United Spanish War Veterans corresponds to the G.A.R., but is devoted to the interests of the survivors of the war of 1898. The Naval and Military Order of the Spanish-American War is confined to commissioned officers of that war or the Philippine insurrection connected with it, and to their sons.

The greatest of all existing patriotic societies in the United States is the American Legion, formed at St. Louis, Mo., in May 1919. All officers and enlisted men who served with the military and naval forces of the United States in the World War of 1914–18 are eligible to membership. Women who were actually in the military or naval service in such positions as Army nurse, Signal Corps telephone operator, or Navy yeoman, are also eligible to membership in the Legion. The organization is nonpartisan; its objects are to keep alive the comradeships formed in the war, to preserve the history of the conflict, and to maintain the principles for which American soldiers and sailors trained, fought, and died in that conflict. Its members are formed into local posts, subject to control by department and national headquarters. The members of the various divisions of the American Expeditionary Force, as well as of the smaller units, also have formed permanent organizations. The War Mothers of America, devoted to patriotic and relief work, is another organization which grew out of the World War.

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

PATRIOTISM

PATRIOTISM is the love of home. There is one little corner of the earth that you love above all others. It is where your home is.

The time will come when you will be far from it, but you will never be beyond the thought of home. Always it will come, and most deeply will it move you when you are far, far away.

For your home is your *own* corner of the world. All the beatings of your heart are wrapped up in it. The things you dreamed in those golden days, all the longings and hopes and expectations, go back there. It is the shrine of all that is happiest and noblest and best in all the chords of memory, in all the stirrings of your heart.

And so when we call our country our Homeland it is something more than a name. We love it as we love no other land. The very soil seems dear to us. It is a second mother to us all, and as you love your mother so you must love your land.

Breathes there a man with soul so dead
Who never to himself hath said,
This is my own, my native land?

We love our home because it shelters us, and so we love our land. We must be free to think and do the things we will; we must be free to live the life we wish to live; and it is to our country that we owe our freedom. It builds about us walls of strength that we rarely see, but let an enemy appear and our land is encircled as by a ring of steel.

The Strength of a Nation is Its People

It is no small thing that our country does for us in guarding our right to a civilized life. We have only to imagine ourselves citizens of Mexico, a country of marvelous natural wealth without security, to realize what government means; and the thing we must never forget is that it is not some power outside ourselves that makes the difference between the United States and Mexico, but that it *is* ourselves. It is *we* who make the nation strong or weak.

And we owe it to our country to keep it strong. All the liberties we have our country has given us; we are free because men toiled and suffered that we should be free. All the knowledge that is written in books our country has given us; it has thrown open our gates that truth and knowledge should pour in from every source. All the pleasures we enjoy our country has given us; it has made our land impossible for tyrants and put the powers of happiness in our hands.

For a thousand years men and women have lived and died, have worked and grown weary, have spent themselves and waited—often in vain—to see the fruits of their labors, that our country should be the land it is for you and me. And shall we, reaping the harvest of freedom, of happiness, of all the treasures of knowledge and wealth, be willing to reap and not to sow?

Patriotism is the desire to make your country the best in the world. It is certainly not to believe blindly in your country, whether right or wrong. You will hear that worst of all phrases again and again as you go through life; there are more shallow people than you can count who think themselves fine patriots because they stand up in market places, or shout in parks, or write in papers, those unpatriotic words—"My country, right or wrong." They are the enemies, and not the friends, of their country who say that!

True Patriotism and the Righteous Cause

No friend of a nation supports it in wrong-doing, for wrong-doing strikes at the heart of a nation, and in the end will bring it down The surest way of helping any country to be great is to help it to do right, and he is the truest patriot who fearlessly supports a righteous cause in those dark hours when it happens to be unpopular. In all great nations such a time will come; and those who love a country for the nobility of its spirit, the richness of its service to humanity, its staunch devotion to the vital welfare of the common race, must weep and not rejoice when a country forgets and forsakes these things, as countries sometimes do.

Once in the history of the United States this cry of the shallow patriot came within an ace of imperiling the freedom of millions of people and the destinies of the American nation. On the eve of the Civil War there passed through the House of Representatives at Washington, a resolution which would have forbidden all amendments to the Constitution dealing with slavery except those proposed by slaveholding states. As the founders of the Constitution had allowed the seed of slavery to be sown, in their fear of the slave-owners, so, long afterward, the guardians of the Constitution were willing, in their fear of the slave-holding states, to let this terrible blot remain forever on the name of the great country which had boldly declared to the world that "all men are created equal"!

Fortunately for human liberty this decision came too late; the war had broken out and could not then be stopped. It was the heart of the people that saved America from the folly of its Congress; then Congress was wrong and the people were right. The "right or wrong" patriotism is in an awkward place at such a time; the only patriotism with a clear path all the time is the patriotism of eternal right.

Heroes and the People

The great patriots of the world—who are they? Their lives make up the common story of our land, and it is the lives of unnumbered common people, and not of a few heroic figures in the center of the stage, that make a nation. Out of the ranks of the people come the shining heroes. The spirit of sacrifice and service that endures all the time, and the sudden heroism that rises to the great occasion, are elements in that broad basis of patriotism on which the heart of the nation rests. The enduring strength of a country is drawn, not from its dramatic forces or its mighty figures, but from the steady flow of life which never fails, which is always there to be called upon —the reservoir of power which we know can be turned on at any moment to sustain those great causes for which the nation stands. Great men are like comets, sweeping now and then across the sky and startling us by their dazzling light; but the people are like the stars, that shine forever and ever.

We must not be led away by the false patriotism that takes a narrow view, and think there are no other countries than our own. We must love mankind, and nothing is more false than to talk as if patriotism expected us to exclude all other countries from our interests. All the world matters to us, for all the world is bound to us, and we are bound to all the world. It is one of the cruelest things that Germany has done that she has polluted the great life-stream of the world; for in peace the life of nations mingles, and there is not a land on earth, and hardly a city or town, where the happiness of races that were blending together has not been broken by the crime that has put the German people for many years outside the pale of civilization. In all great countries she has sown the seed of ill-will in homes where German blood has mixed.

Patriotism is Not Narrow

Yet, though we must love the world, we may love our country best. There is nothing small in this. We love our friends, but we love our mother best, and it is right and good that we should cherish our own country most. It is right, because our country has given us all; it is good, because it is through our own country that we best help the world. It was a great Frenchman who said, "Let my name be polluted, but let France be free"; and he meant that it did not matter though he should be forgotten or dragged down, so long as France was free. Mr. Kipling has said the same thing in that great line, "Who dies if England live?" One of the greatest patriots of the world was also among the greatest patriots of France. It was Pasteur, and when he was dying he said these noble words: "I am sorry to die, because I wanted to do so much more for my country."

It has the sanction of heaven itself, this love of country. The Jews sat down captive by the rivers of Babylon. They hung their harps on the willows, and they sang the Lord's song in a strange land, but they wept when they remembered Zion. "If I forget thee, O Jerusalem, let my right hand forget her cunning. If I do not remember thee, let my tongue cleave to the roof of my mouth."

And as for us, if we forget our native land, let Liberty forsake us!

OUR COUNTRY

First in the glories of thy front
Let the crown jewel, Truth, be found;
Thy right hand fling, with generous wont,
Love's happy chain to furthest bound.

Let Justice, with the faultless scales,
Hold fast the worship of thy sons;
Thy Commerce spread her shining sails
Where no dark tide of rapine runs.

So link thy ways to those of God,
So follow firm the heavenly laws,
That stars may greet thee, warrior browed,
And storm-sped angels hail thy cause.

O Land, the measure of our prayers,
Hope of the world, in grief and wrong!
Be thine the blessing of the years,
The gift of faith, the crown of song!

—Julia Ward Howe.

PAUL, SAINT. Saul of Tarsus, fiery persecutor of the early followers of Jesus, was one day going down the road to Damascus to take prisoner all the Christians he could find there. Suddenly, according to the account in Acts ix, a great blinding light shone down on him, and a voice said, "Saul, Saul, why persecutest thou me?" Trembling, Saul asked, "Who art Thou, Lord?" and the voice answered, "I am Jesus, whom thou persecutest."

Saul, shaken and still blinded, proceeded on to Damascus, a follower of the man whose disciples he had started out to imprison, and "straightway he preached Christ in the synagogues, that He is the Son of God." With such a great change in his convictions it is not strange that the Pharisees, the strict Jewish sect to which he belonged, thought him mad, and the followers of Jesus believed he was a spy. So he left Jerusalem and went to his old home Tarsus, spending three years chiefly in meditation and retirement. Then he took up his mission and went to many other towns in Asia Minor and Greece, establishing churches and gaining many converts to Christ.

Saul, or Paul, was a Roman citizen, the son of parents who were prominent Hebrews of Tarsus. The boy was educated under the most distinguished rabbis of the day at Jerusalem, where he was carefully trained in the strict faith and in the traditions of the Jews. All of the boys of his nationality learned some trade and Saul was taught to make tents, and later, on his preaching tours in various cities, supported himself by tent-making.

He was made a member of the Council of Jerusalem while yet a young man. With his strict training it is no wonder that when Jesus called the Pharisees humbugs and wolves in sheeps' clothing, and said that the strict rules they observed would not save them, Saul was shocked and angry.

After his conversion, which occurred when he was about 32 years old, he spent some time in meditation, and visited Peter to learn of the life of Jesus, whom, it is believed, he never saw during his lifetime. Then he started out on his great missionary travels. His method was always the same. First he spoke in the synagogue, and when the Jews became hostile he would withdraw and organize a church of the Gentile-Christian order. This aroused the conservative element of the early Christians, who did not agree with Paul that a man could be a Christian without first going through certain Jewish ceremonies. It was Saul, or Paul, as he preferred to call himself after his conversion, who first conceived of Christianity as a world-wide religion, and who formulated the theology of the Christian Church, for his logical mind and training in the law made him supreme in the field of definition and controversy.

He so antagonized the Jews that when he returned to Jerusalem he was seized and thrown into prison, where he was kept two years. Finally he availed himself of his right as a Roman citizen and appealed to the Emperor Agrippa. He was sent to Rome and held there, a virtual prisoner, for two years more. According to tradition he was later arrested and beheaded by order of Nero.

The Epistles of Paul, which form a considerable part of the New Testament, are letters he wrote to his friends and to the various churches. Many of them were written while he was in prison. The Book of Acts tells much about him and his work.

PEA. Will you have your peas early or late, dwarfed or tall, smooth or wrinkled, large or small? A wide range of selection is open in the 200 varieties of garden peas, to say nothing of the many field and ornamental varieties. Fine, fresh, tender peas are a delicacy for the table of the most fastidious; yet from time immemorial peas have been the "meat" or protein food of the poor. The most remarkable thing about peas and the whole leguminous or pod-bearing group of plants to which they belong is their unique ability to produce a nitrogenous food for man and beast and at the same time to enrich the soil in which they grow by nitrogen compounds (*see* Nitrogen). The cheapest form in which the necessary protein foods can be obtained is in peas or some other legume.

The most obvious difference between the pea and its cousin the bean is the pea's tendril, borne instead of a terminal leaflet on the leaf. Garden peas are eaten green and fresh (with the pod in the case of the sugar pea alone) and are canned in immense quantities, in many sections of the United States.

The coarser, blue-flowered field peas are grown for stock food, both plant and fruit being used as silage. The seeds are also used dry and ground with stock-food mashes, and form the "split pea" used for soup and pea-meal.. Sweet peas are an ornamental species developed for the blossoms. Cowpeas or "black-eyed peas" are really beans (*see* Cowpea).

Scientific name of garden pea, *Pisum sativum.* Leaves pinnate with a terminal tendril; flowers white, five-petaled, and butterfly-shaped. Some of the most popular varieties are the *Alaska* (small) and the *marrowfat* and *telephone* (large). The *chick-pea,* whose starchy seeds are much used in Mediterranean countries and central Asia, belongs to another genus of the same family (*Leguminosae*).

PEACE RIVER. More than 25,000 square miles of the best farming land in all Canada lies along the course of this great river, with a length of more than 1,000 miles from its sources in the Rockies to its union with the Slave River in northeastern Alberta, near where that stream emerges from Lake Athabaska. For years the opinion prevailed that the Peace River country lay too far north ever to be considered a part of Alberta's rich grain belt; but early in the 20th century experiments disclosed that wonderful crops of wheat, oats, barley, and vegetables could be grown here during the brief summer. The soil is remarkably fertile, and the climate is far warmer than was expected in such high latitudes; this is partly because of the warm "chinook" winds that blow from the Rocky Mountains (*see* Winds), and partly because the surface of Alberta slopes toward the north, so that the Peace River region is several hundred feet lower than the southern part of the province. There is only two degrees' difference in average summer temperature between Fort Vermilion, in the northern part of the Peace River region, and Cardston, 700 miles to the south. With this equality of temperature, crops mature even earlier in the north than in the south of the province, because they have the additional advantage of very long days of sunshine—as much as 18 hours at midsummer.

Less than a generation ago maps of this part of Canada showed only a few trading posts. Today they are thickly sprinkled with the names of towns and villages which have sprung up with marvelous rapidity. A railway has been built from Edmonton to the Peace River, thus establishing connection with the vast Mackenzie system of northern waterways; for the Peace River is navigable, except at one obstruction, from the spot where it leaves the Rockies to the Slave River.

The Peace River is also remarkable for the fact that it takes its rise on the west of the Rocky Mountains but flows eastward through the range by "a veritable gateway of nature"—a valley a mile wide between mountains rising 2,000 to 4,500 feet above it. It is formed in British Columbia by the junction of the Parsnip and Finlay rivers.

PEACH. You might not guess that the peach and almond were first cousins, and yet this is probably the case. Indeed, one variety of peach still has an edible almond-flavored kernel within its hard stone. Nowhere has the peach been found in the wild state. All of the 300 varieties which are grown in the United States are the result of long cultivation.

Popularly peaches are classed either as "freestones" or "clings," but there are many gradations. Some varieties are yellow fleshed and some white, and there is considerable variation in size, flavor, hardiness, and other qualities. The nectarine is a smooth waxy-skinned variety with a firmer and more aromatic pulp.

The peach is a delicate exotic, and has the unfortunate habit of blossoming early, thus exposing the fruit to danger from late frosts. It can best be grown, therefore, where frosts do not come or where cold springs delay the buds until the danger of frost is past, as on the Allegheny hillsides. The chief peach-growing regions in the United States are an eastern belt stretching from Connecticut, particularly the Maryland-Delaware peninsula east of Chesapeake Bay and the Alleghenies west of the Great Valley to Georgia; the eastern and southern shores of the Great Lakes; parts of southern Illinois, Missouri, Arkansas, Louisiana, Oklahoma, and eastern Texas; and most of California.

Commercially the fruit ranks next in importance to the apple. Because it is so perishable it scarcely entered into commerce until fast trains and refrigerator cars made it possible to market California peaches in Chicago and New York; and even yet many of the best peaches cannot be marketed except near the place where they are grown. The fact that the peach is exacting to grow, must be picked as soon as it is ripe but before it is soft, and cannot be kept more than ten days or two weeks at most, makes it a luxury rather than a staple.

RIPE AND READY TO DROP

Peach growers usually thin out their peaches to stand 5 to 6 inches apart. Peaches grow only on wood of the preceding season's growth.

In England and Europe peaches are commonly grown under glass or trained on sunny walls, and while the fruit produced is of the highest quality, the cost is prohibitive for all but the rich.

The peach (*Prunus persica*) belongs to the same genus as the plum, apricot, and cherry. The tree is small, from 10 to 20 feet high, and bears many branches, the fragrant pink blossoms usually appearing before the leaves. The trees are short-lived and are exposed to many diseases.

PEACOCK. The proverb "as proud as a peacock" does no injustice to the handsome male of this species, which belongs to the pheasant family. His gorgeous plumage combines the metallic shades of bronze, blue, green, and gold, and a crest adorns his head. But his chief glory is the long train of brilliantly marked plumes which grow just above the tail feathers and which, with the quills of the tail, he proudly lifts erect and spreads fanwise to charm the less ornate peahen or the human beholder.

Peafowls are natives of India and Ceylon, where they are common in a wild state. One cock and three or four hens usually constitute a flock. The nest is a rude affair on the ground, or on low branches, and contains about six eggs. Male and female of the young birds are feathered alike until about two years old; then the tail coverts of the male begin to develop their brilliant colors.

"JUNO'S BIRD" WITH THE HUNDRED EYES

The magnificent plumage of the Peacock has made him a favorite pet since the days of Alexander the Great. It is said that these birds occasionally reach a great age, but their average span of life seems to be from 20 to 30 years.

Domestic peacocks, now common in almost every country, date from very ancient times. To the ancient Greeks the peacock was known as Juno's bird; according to a well-known myth, the strange eyelike markings of the covert plumes were the hundred eyes of the giant Argus, set there by Juno.

In days of chivalry a special feast-dish was the roast peacock served up garnished with all its gaudy plumage. Solemn oaths were sometimes taken "on the peacock."

Under the Chinese Empire a peacock feather was a distinction awarded to mandarins for public services. These birds have long been the symbol of splendor. The famous peacock throne of the Mogul emperors at Delhi was of unparalleled magnificence, for it had as its background the figure of a peacock with expanded tail wrought all in gold and precious stones.

The Japanese peacock has upper wing coverts of deep lustrous blue, from which the color term "peacock blue" has arisen. The hen of this species is a grizzled white. It is from this variety apparently that the sacred white peacock of India was developed. Scientific name of common peacock, *Pavo cristatus*.

PEANUT. "Fresh-roasted, double-jointed, jumbo peanuts! Peanut brittle! Salted peanuts!" cries the circus man with the big basket on his arm, or the boy merchant at the baseball game. But this does not tell half the fascinating story of the peanut.

It is one of the most useful of plants. From the appetizing and nutritious nuts we get peanut oil for cooking and peanut butter for our sandwiches. Peanut oil is largely used also as a salad dressing in place of olive oil, which it closely resembles, and for soap making, oleomargarine, packing sardines, etc. For feeding and fattening stock, the vine is almost equal to the best clover hay. Peanut hulls have the food value of coarse hay, and the thin skin that covers the nut itself can be used in the place of wheat bran in cattle fodder. Finally, the roots of the plant, if left in the soil, enrich it with invaluable nitrogen products (*see* Nitrogen). There is thus very little about the peanut plant that cannot be used in some way or other.

The food value of the nuts, long eaten merely as a relish, is only beginning to be appreciated. They contain "per pound more protein than a pound of sirloin steak, plus more carbohydrate than a pound of potatoes, plus one-third as much fat as a pound of butter—an amazing total." Unlike dairy products and meat, the nuts keep without deterioration for years. The United States Department of Agriculture urges the use of peanut meal as a meat substitute, in soups, and mixed with other meals and flours in griddle cakes, muffins, etc.

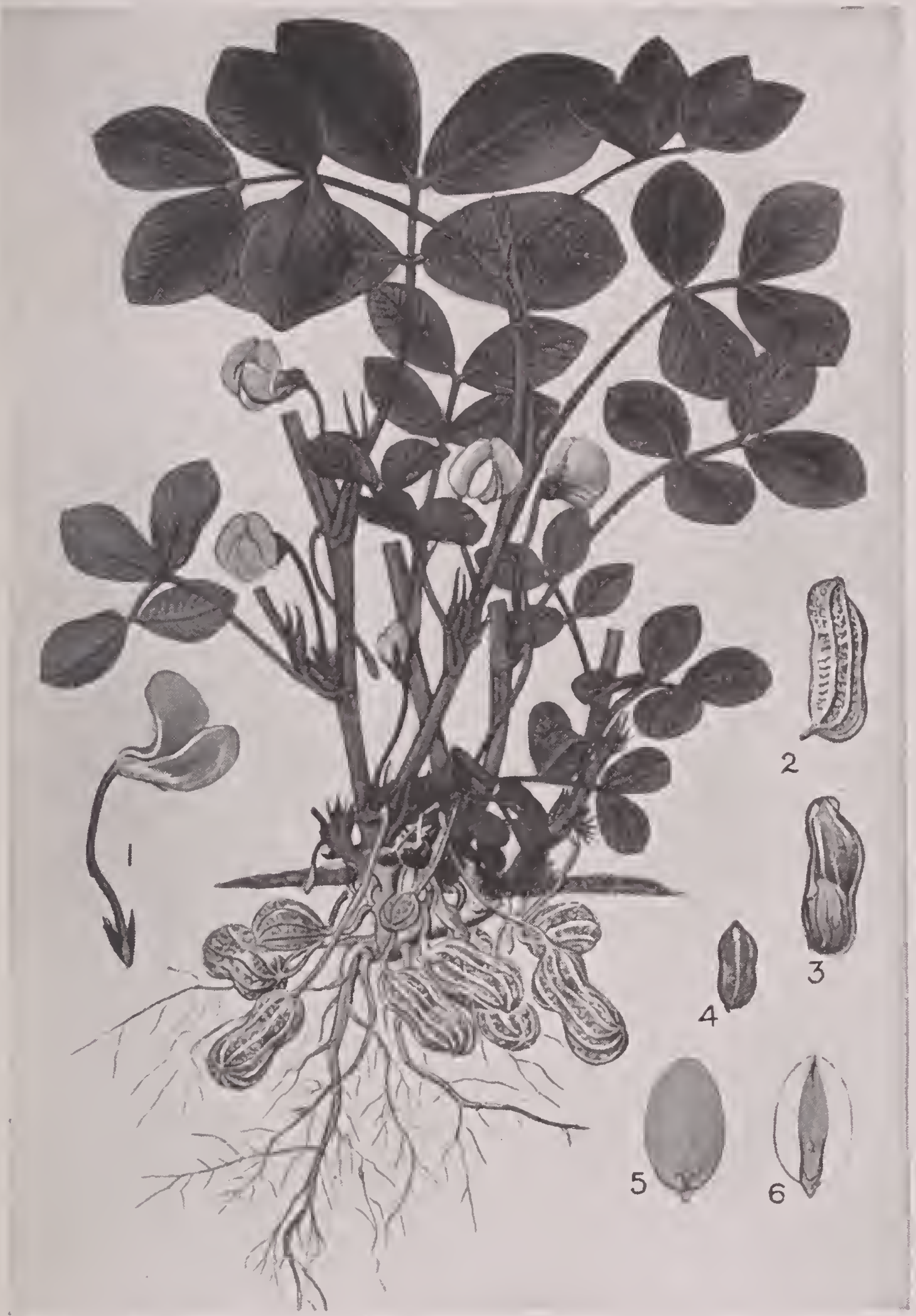
The peanut plant is remarkable for the way it produces its fruit. After the flowers have fallen, the flower stalks bend down and push into the ground, where the pods or "nuts" develop. From this it is called the groundnut, earthnut, and ground pea or goober in various localities.

The plant (*Arachis hypogaea*) grows from the Brazilian tropics, where it originated, to Virginia and Argentina, and from Senegal to China. Because it can endure long drouth and grow when rain comes it is of especial value in semi-arid regions, as the southwest of the United States. The yield per acre is from 34 to 60 bushels of nuts in the shell, with a ton to a ton and a half of good hay. If an acre of land can produce 20 bushels of wheat, 40 bushels of oats, or 40 bushels of peanuts, it will yield 154 pounds of digestible protein in the wheat, 149 in the oats, or 186 in the peanuts, and 24 pounds of fat in the wheat, 61 pounds in the oats, and 300 pounds in the peanuts.

Although most of the peanut crop in the United States is used as human food, it has been found very profitable to "sell peanuts as pork." Under this plan, the tops of the plants are cut and gathered for hay, then hogs are turned into the field, where they root out the nuts and eat them, gaining weight rapidly with this diet.

Since about the time of the Civil War the peanut has been grown in the Southern states in increasing quantities. In many cases, especially in the boll-weevil district, it is more profitable than cotton. The American peanut is larger and finer-flavored than any other, but contains less oil than the African nut. Two types chiefly are grown in the United States, the large-podded white or red peanut, with two, three, or even four kernels; and the Spanish or African small-podded peanut which produces small roundish peanuts of milder flavor. The crop in the United States is about 20,000,000 bushels (88,000,000 pounds) a year. The world crop is 600,000,000 pounds.

HOW FLOWERS TURN INTO PEANUTS



A peanut plant in bloom, showing also (1) the flower stalk from which the pod develops; (2) a whole pod; (3) a pod opened to show the seeds; (4) a seed; (5) a seed with skin removed; (6) a seed split.

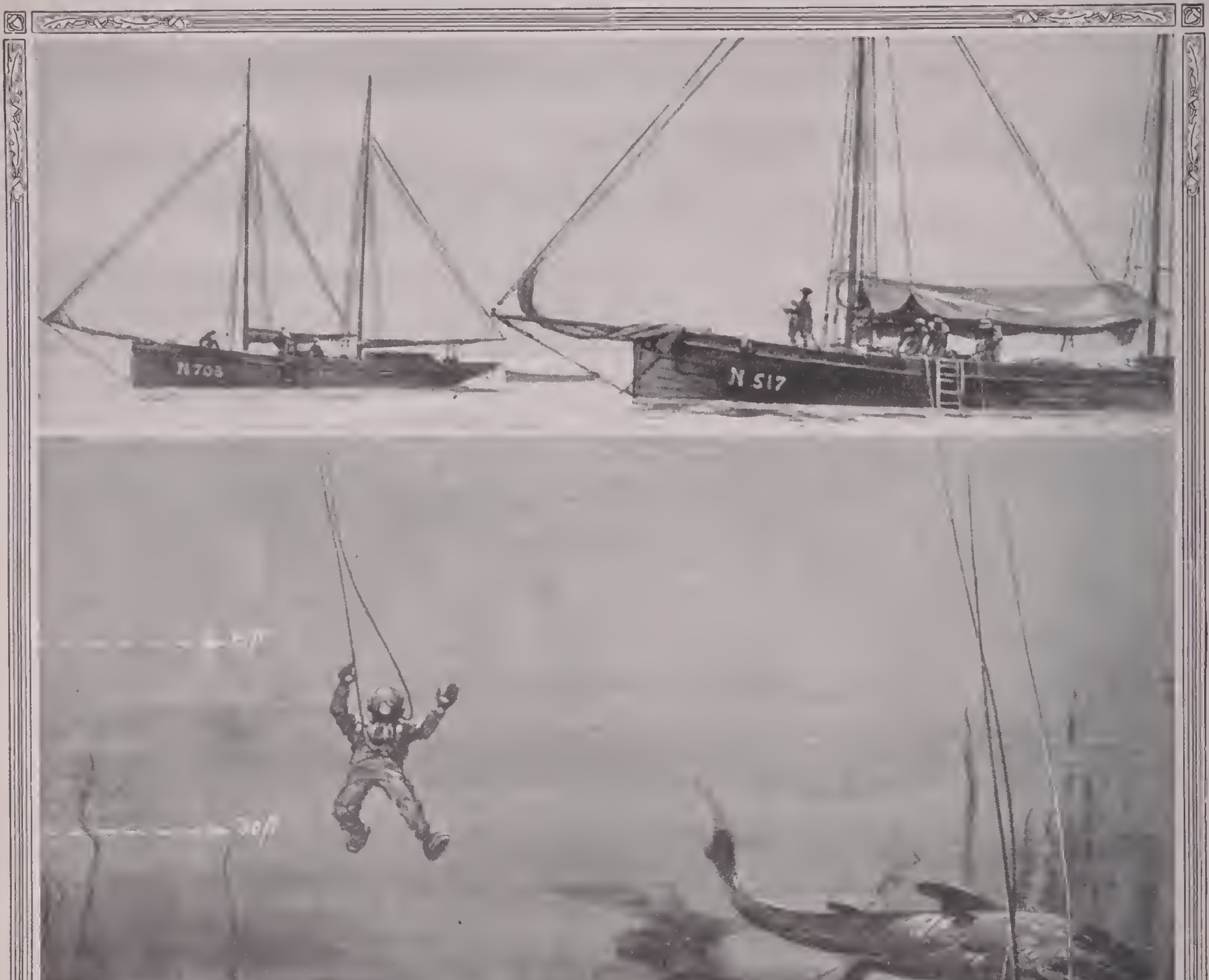
PEAR. The worst fault of this delicious fruit is the hospitality extended by the tree to various insect pests. The inedible Chinese sand pear is hardier, is immune to the pear blight, and has a wider range of cultivation than the tender, juicy European varieties. Hybrids between the two kinds have been produced which combine many of the desirable qualities of both, and good results are also obtained by grafting superior fruited varieties on the hardy rootstock of oriental pear seedlings.

The pear tree was probably a native of western Asia, but it is now grown in all temperate climates, with France and the United States as the principal producing countries. Among American orchard fruits pears rank fourth in importance. From New England to the Great Lakes, in California, and also in portions of Oregon and Washington are the principal regions of cultivation in America. In England the pear is trained to grow fan-wise on walls exposed to the southern sun, for the climate there is too cool for the fruit to ripen otherwise. The popular Bartlett pear, widely grown in America, is a variety brought from Europe, where it is known as "bon-chrétien." The small Seckel pear excels in flavor and quality of its fruit. The large Kieffer pear, excellent when baked but almost uneatable raw, is one of the best of the oriental hybrids.

Pears are usually picked while they are still hard and imperfectly colored, for if they are left on the tree they become tasteless and gritty; after picking they are stored in a cool place to mellow. Pears are popular as a dessert fruit, and are extensively canned, preserved, spiced, and pickled.

The cultivated pear tree is free from thorns, but on the young wild pear tree the ends of the branches form sharp spines guarding the fruit of the tree. Many of the disease and insect pests which attack the pear are the same as those which attack the apple, but there is a distinct pear-leaf blight, which is best remedied by spraying with Bordeaux mixture. Like so many of our orchard fruits, the pear (*Pyrus communis*) belongs to the rose family.

SNATCHING NEPTUNE'S ONLY GEMS



The pearl is the only precious gem which is obtained from the sea. Unlike mineral gems, such as the diamond, the pearl needs no cutting to improve it. Except for a little polishing it is a finished gem when it is taken from the oyster. The finest pearls come from the Far East, many of them gathered by Japanese or Malay divers who simply plunge in, holding a heavy stone which helps to pull them to the bottom. Where the pearl gathering industry is better organized, the men are equipped with diving suits, as you see here. When one of these divers has been down a long time he has to be pulled up in " stages," waving his arms and legs to quicken his circulation and so get rid of the excess nitrogen he has absorbed while breathing the compressed air. Divers, particularly the naked natives, are occasionally attacked by sharks, or seized by octopi and held down until they drown.

PEARLS. Most shell-covered water animals or mollusks line their shells with a secretion which produces a smooth, whitish shimmering inner surface called nacre or mother-of-pearl, much used for buttons, knife and fork handles, inlay work, etc. This lining is to protect the delicate bodies of the animals from contact with the otherwise rough covering. Doubtless you have often admired the enamel-like glossiness of the inside of a shell. The secretion is deposited in a series of milky, satiny, transparent films which, hardening, produce a beautiful play of colors.

OPENING THE SHELLS TO LOOK FOR PEARLS

What a fascinating task this must be! Who knows but the very next shell may contain a pearl worth a fortune? Below is one of the pearl oysters containing a large "stone." Pearls must be handled with care. Hot water destroys their luster; for this reason pearl rings should always be taken off before washing one's hands. Pearls seem to require the touch of life to keep them brilliant; they have been known to get "sick" and "die" when not worn for a long time.

A pearl is really a calcareous (limestone) deposit of a sick mollusk. Often a grain of sand, a minute marine creature, or other foreign substance finds its way into the shell and irritates the animal. Then the animal, unable to remove it, covers it with successive layers of this membranous substance, and thus pearls are formed. Sometimes the animal is attacked by a parasite boring through the shell from the outside. It repairs the damage by depositing its secretion over the hole in the form of a half sphere, thus forming a blister pearl.

Genuine precious pearls and the most valuable mother-of-pearl are produced by various species of pearl oysters of the genus *Meleagrina*, although inferior pearls are sometimes found in the common edible oyster. Since the pearl naturally partakes of the character of the shell, it is useless to look for pearls of value in the dull opaque shell of the ordinary oyster. Pearl oysters lie on the hard sea bottom at a depth of from 50 to 150 feet. They are collected by divers working in crews. They may be opened on board ship or they may be gathered in boatloads and taken to the beach, where they are spread out to decompose. Afterward they are washed and the pearls are removed carefully with special pincers or hammers. (*See* Diving; Oysters.)

Fresh-water pearls are found in a family of fresh-water mussels. Some of the most valuable seed pearls (the smallest pearls) are found in mussels in the rivers of Scotland, Ireland, Germany, Russia, China, etc.

In the 13th century the Chinese discovered a process for the artificial formation of pearls in river mussels. A minute foreign substance is introduced into the shell of the mussel, creating an irritation and causing the animal to form a pearl. The process is still used and forms a staple industry in several Chinese villages. The best pearls, however, are not so formed.

The finest pearls are gathered in the East, the most valuable, worth tens of thousands of dollars, coming from the oysters of the Persian Gulf. Among other important pearl fisheries are those in the Sulu Archipelago, off the Australian coast, in the Aru Islands, the Pearl Islands, in the Bay of Panama, in the Red Sea, off the Philippines and Burma, and in Ceylon. The largest pearl fishery in America is that of Lower California, from which come the largest and finest black pearls on the market. The largest pearl known is two inches long and four around, and weighs about three ounces.

PEARY, ROBERT EDWIN (1856–1920). "Stars and Stripes nailed to the North Pole. — PEARY." It was on the afternoon of Sept. 6, 1909, that this dramatic message, flashed by cable and telegraph, thrilled the world. So the long fight had been won at last—the fight of three centuries, in which so many men of different nationalities had given their lives, and in which so many deeds of daring and fortitude had been performed.

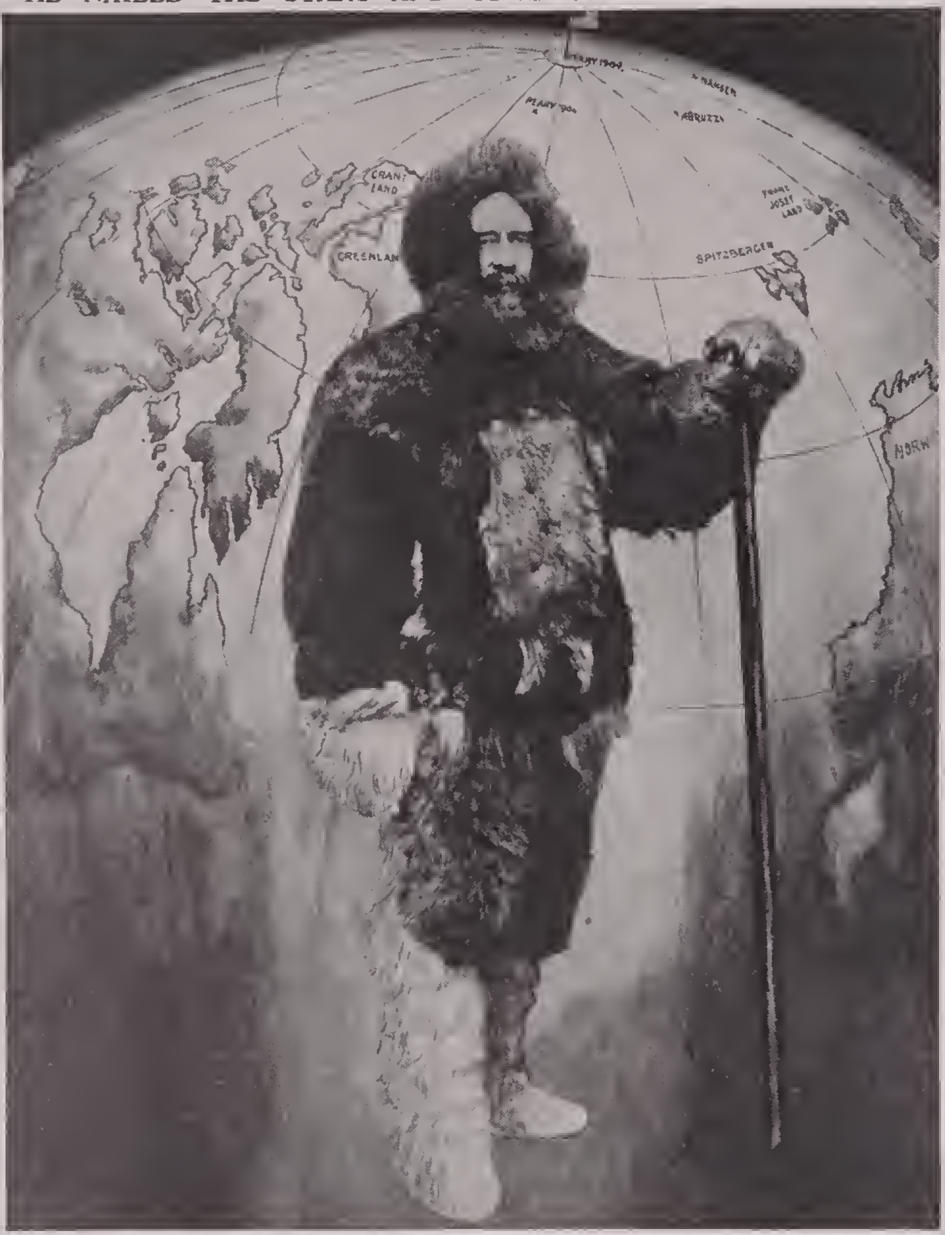
Peary had actually found the pole on April 6, 1909, just five months before his message was received. He was the only white man of his expedition to reach it. With him on the sledging party, in the last dash, were his negro follower Matthew A. Henson and four Eskimos. For 53 days they and their dog teams marched across the polar ice-pack, from the last point of land to the pole, and back, a distance of 950 miles. The way was beset with many dangers, yet courage and the wisdom born of long Arctic experience conquered them all.

It was no accident that the long-coveted prize should have been won by Peary. For 20 years he had hoped and worked, returning time and again to the polar regions, always learning from his failures, always paving the way for the final victory.

Born in Pennsylvania and educated at Bowdoin College (in Maine), at 25 he had entered the United States navy, after a civil engineer's training, and in 1887–88 he was chief engineer of the Nicaraguan Canal survey. The year before that, at the age of 30, he had made his first trip to the Arctic regions, visiting the Greenland ice cap. From that day onward the lure of the North was in his blood, the great white spaces haunted him in dreams, and he could never again live at ease. His wife shared his ambition, and spent several winters with him in the Far North, where their little daughter was born. The child was called the " Snow Baby " by the Eskimos, because her skin was so white.

The expedition which finally reached the pole was the eighth which Peary had made into the Arctic regions. They had all been of much scientific value. Peary had explored Greenland, crossing its northeastern corner in one of the most remarkable sledge trips ever made, and had proved it to be an island (1891–92); he had brought home the great Cape York meteorites, the largest in the world; he had obtained a vast mass of valuable information in different fields, and he had several times attempted to get to the pole itself, without success. On one of these expeditions he froze his feet so severely that he lost his toes.

HE NAILED THE STARS AND STRIPES TO THE NORTH POLE



Rear Admiral Robert E. Peary reached the North Pole on April 6, 1909, after seven previous efforts. The points farthest north reached by Dr. Nansen, the Duke of Abruzzi, and Peary himself on his previous trip in 1906 are shown on the globe. Peary is shown here in the garb he wore when he made his historic discovery on April 6, 1909.

For his final success he received great honors from nearly all the important nations, and the United States raised him to the rank of rear admiral. The claim which Dr. Frederick A. Cook put forth just four days before Peary's message was received, stating that he had reached the pole a year before, is now universally discredited.

Peat. The making of peat is the first step in the making of coal in Nature's great factory. Peat is a dark brown or blackish mass of partly decayed vegetation formed in marshes, swamps, and bogs. All sorts of marsh plants, from mosses to trees, enter into its composition. It is much used for fuel in northern and northwestern Europe. Peat is found chiefly in rather high latitudes, mostly in the Northern Hemisphere. This is because most marshes and bogs are in the high latitudes of the Northern Hemisphere, and not because, according to a common idea, vegetable matter decays too rapidly to form peat in low latitudes. Dismal Swamp, in Virginia, is a fine example of a peat bog. Most peat bogs are within the area that was once glaciated, because that is where most undrained depressions appropriate for bogs are found. A common plant in many peat bogs, which helps to form peat, is a moss known as sphagnum moss or bog moss (*see* Moss). Peat deposits grow from 2 to 4 inches a year.

The manner of peat formation is as follows: the various marsh plants continue to grow above and decay beneath. The decaying matter below is in water and forms a heavy mass of water-soaked tissue which, as time goes on, becomes thicker and thicker and more deeply buried beneath the new growth. Under increasing weight above, it is pressed into the rather spongy dark-colored substance known as peat. If the peat is buried deeply beneath sediments, such as mud, it is compressed much more, and at the same time it is cut off from contact with the air. Chemical changes take place in it, and in the course of long ages—millions of years—it is transformed into a form of coal.

IRISH PEAT CUTTERS AT WORK

The cutters use a spade, and pile up the blocks to dry. A peat bog is moist and spongy to walk on.

Peat bogs tend to preserve vegetable or animal remains which become buried in them. The leaves of plants which compose it are in some cases so well preserved that it is possible for botanists to determine the species to which they belonged. In some instances, human and animal bodies have been found in peat bogs in a good state of preservation, even after the lapse of several centuries, as shown by the fact that with them are weapons, tools, and armor of the men of the distant past.

THE MOST VALUABLE NUT OF THE SOUTH

In sections where they can be raised, Pecan trees yield a greater revenue than any other tree.

Peat is cut out in blocks by the peasants in Ireland and other countries and piled in the sun to dry. It burns slowly, gives a dense black smoke, and leaves much ash. Peat compressed into compact bricks forms a much better fuel than in its natural state, but it has come into general use only where the supply of other fuels is meager. Peat is also used, though not extensively, for the making of paper, for fertilizing soils and for stable litter.

PECAN′. The pecan, because of its thin shell and fine-flavored kernel, has long been a prime favorite in America, and in the past few years has become the most valuable commercial nut in the United States. The tree (*Carya pecan*) is a member of the hickory family and is found native in the United States as far north as Illinois and in Mexico.

While the great bulk of the market supply comes from native trees along river bottoms, plantations of considerable extent have been set out in Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Florida, and in central and northern California, and the demand still far exceeds the supply. The pecan will thrive as far south as the Gulf of Mexico, and as far north as central New York, although in the higher latitude crops do not pay cultivation. It is especially well adapted to the sections drained by the Mississippi as far north as central Illinois and central Indiana, and to "two-story farming," which means planting the trees thinly scattered in fields where quick-growing crops like cowpeas, sorghum, or clover are raised for pigs to harvest.

The trees begin to bear a few nuts the third year, but not until the tenth or twelfth year can commercially valuable crops be expected. An annual yield of 50 to 100 pounds per tree is satisfactory and the yield may be larger, depending on the size and age of the tree. Under favorable conditions the trees will live to a great age, and there are, living and bearing in Texas and other Southern states, trees that are said to be 300 years old. There are about 100 different varieties, many being cultivated improvements of the native tree. The nut grows in a husk or outer shell very much like a hickory nut and falls from the opened husk when ripe.

The pecan meats of commerce are shelled by machinery. The nuts are fed down from a hopper, seized singly between clamps at either end, and cracked. The rapid fingers of girls and women pick out the meats and sort them. Into one barrel go the perfect meats, into another the broken ones.

PEC'CARY. This piglike animal of the New World is sometimes called the muskhog, from the presence of a large gland on the rump which emits a powerful odor. There are two species. The more northern or collared peccary occurs as far north as Red River in Arkansas, and ranges south to Rio Negro in Argentina. This species is about three feet long, occurs singly or in small herds of eight or ten, and is comparatively harmless. The white-lipped peccary is about 40 inches long, and like the collared peccary is covered with thick bristly hair; its range is between Paraguay and British Honduras. White-lipped peccaries occur in herds of 50 to 100 or more, and when attacked fight fiercely with their small but sharp tusks. Both kinds live on roots, fruits, worms, and the like. In cultivated districts they do some damage to crops, but, on the other hand, are of service to the farmer in destroying reptiles. Scientific name of collared peccary, *Dicotyles tajaçu* or *torquatus;* of white-lipped peccary, *Dicotyles labiatus*.

PEEL, SIR ROBERT (1788–1850). "Here comes a Bobbie," shouts the mischievous London street urchin when he sees a policeman approaching, and a lad in Dublin in a similar situation may cry out, "There's a Peeler." Both of these nicknames for the blue-coated officer of the law come from the name of Sir Robert Peel, the British statesman who first organized the London police force (1829) and also the Irish constabulary.

This man, the son of a rich cotton manufacturer, a graduate of Oxford University (1808) with the highest honors attainable, and twice prime minister of Great Britain, was the author of many epoch-making measures. And yet he entered Parliament in 1809, at the age of 21, as a Tory who believed in the established order. This was the time when England, in arms against Napoleon, was opposed to all change because of fear of the radicalism of the French Revolution. After the close of the war this feeling wore away, and the march of political progress went on.

When Peel was in the Duke of Wellington's cabinet, in 1829, he proposed and carried through the Catholic Emancipation Bill, giving Catholics the right to become members of Parliament and hold other offices (*see* O'Connell, Daniel). This was a complete reversal of the former positions of Peel and Wellington and it almost split the Tory party; but Peel and Wellington believed that it was the only measure that could preserve peace in Ireland.

Peel while out of office opposed with all his might the great Parliamentary Reform Bill of 1832 (*see* Russell, John). In the years of Whig administration that followed he devoted his energies as a member of Parliament to strengthening the Conservative party, as the Tories were now beginning to be called. As the recognized head of that party, he was prime minister in 1834–35; but as the Whigs still had a majority in the House of Commons, he soon resigned.

By legislation restoring spécie payments (1823) and other measures, Peel had already won the reputation of a financier and statesman of the first rank. His great opportunity for constructive reform came in his second ministry (1841–46). Tariff duties were lowered, laws limiting the employment of women and children in mills were passed, foreign relations with France and the United States were improved, and a new charter was passed for the Bank of England.

Then came the crowning act of Peel's career, in 1846.. Because of a potato famine in 1845 thousands in Ireland faced starvation. For a number of years an Anti-Corn Law League in England had been agitating to secure the repeal of the import duties on grain, in order to cheapen food; but the Conservative party, largely made up of landlords, had opposed the measure. Although Peel was a "free trader" on all else, on grain he had hitherto followed his party. But now "famine forced his hand," and with the aid of the Whigs he repealed the Corn Laws, as a relief measure for Ireland. Many of Peel's followers deserted him, and he was soon defeated on a measure in Parliament and forced to resign as prime minister. Though he had "lost a party, he had won a nation," and for the remaining four years of his life the liberal measures passed by the Whigs were largely due to his support. When he died, from the effects of a fall from his horse a few years later, the common people felt that they had lost a friend who had given them "bread unleavened with injustice," and all England recognized the loss of a great statesman.

PEGASUS (*pĕg'ȧ-sŭs*). When Medusa was slain by Perseus, there sprang from her body, according to the old Greek story, the winged horse Pegasus (*see* Perseus). Bellerophon caught and tamed Pegasus by means of a golden bridle which the goddess Athena (Minerva) presented to him, and mounted on his back was able to slay the Chimera, a fire-breathing monster, part lion, part goat, and part dragon.

Pegasus remained the faithful companion of Bellerophon, carrying him wherever he chose. At last Bellerophon impiously attempted to mount up to heaven, but Zeus (Jupiter) sent a gadfly which stung Pegasus so that he threw Bellerophon, who fell to the earth, lame and blind. Pegasus, however, was placed among the stars.

It was said that the sacred spring Hippocrene on Helicon, the mountain of the Muses, was opened up by a blow from Pegasus' hoof. For this gift the winged steed was greatly honored by the Muses. Because of his association with the Muses, Pegasus has come to be regarded as the poets' steed, who bears them aloft into the realms of fancy.

PEKING′, CHINA. A city of crowds and huge walls, of mud and dust, of incredible filth intermingled with a strange and ancient oriental beauty; a city where patches of European life seem to float, like oil on water, without ever mixing; a city which seems intensely busy with hopeless and futile tasks, where customs born centuries ago are struggling blindly with modern problems—this is Peking, which has been the capital of China since 1409. Its name means "Northern Capital," contrasting it with Nanking in the south, the former capital.

As you walk down a narrow squalid street, groping your way through never-ending streams and eddies of yellow humanity, you hear shrill cries of warning, and squeeze yourself against a doorway while a caravan of camels lumbers by. They have come perhaps from far-away Mongolia, across the Gobi Desert, through the Great Wall, bringing to Peking rich wares from the north. They force a path through the tangle of two-wheeled hooded horse-drawn carts and the man-drawn rickshaws. A lean barelegged rickshaw puller protests, hurling a volley of insults at the camel drivers, while the stately Chinese merchant sitting in the vehicle looks on unmoved, his hands folded out of sight in his flowing sleeves. A policeman, in strange quilted trousers and carrying a sword, turns his back on this confusion and lets the traffic disentangle itself as best it can.

To get a good view of Peking one mounts the famous wall of the Tatar City, as the northern portion of the Chinese capital is called. This wall is 42 feet high and nearly 40 feet broad at the top, and marked off at intervals by lofty and imposing watch-towers. It is a relic of the Tatar invasions of the 10th and 12th centuries, and incloses the former Imperial City, as well as the famous Forbidden City where the emperor used to live, and which only a few foreigners had ever penetrated until the Boxer rebellion brought European and American troops to Peking in 1900.

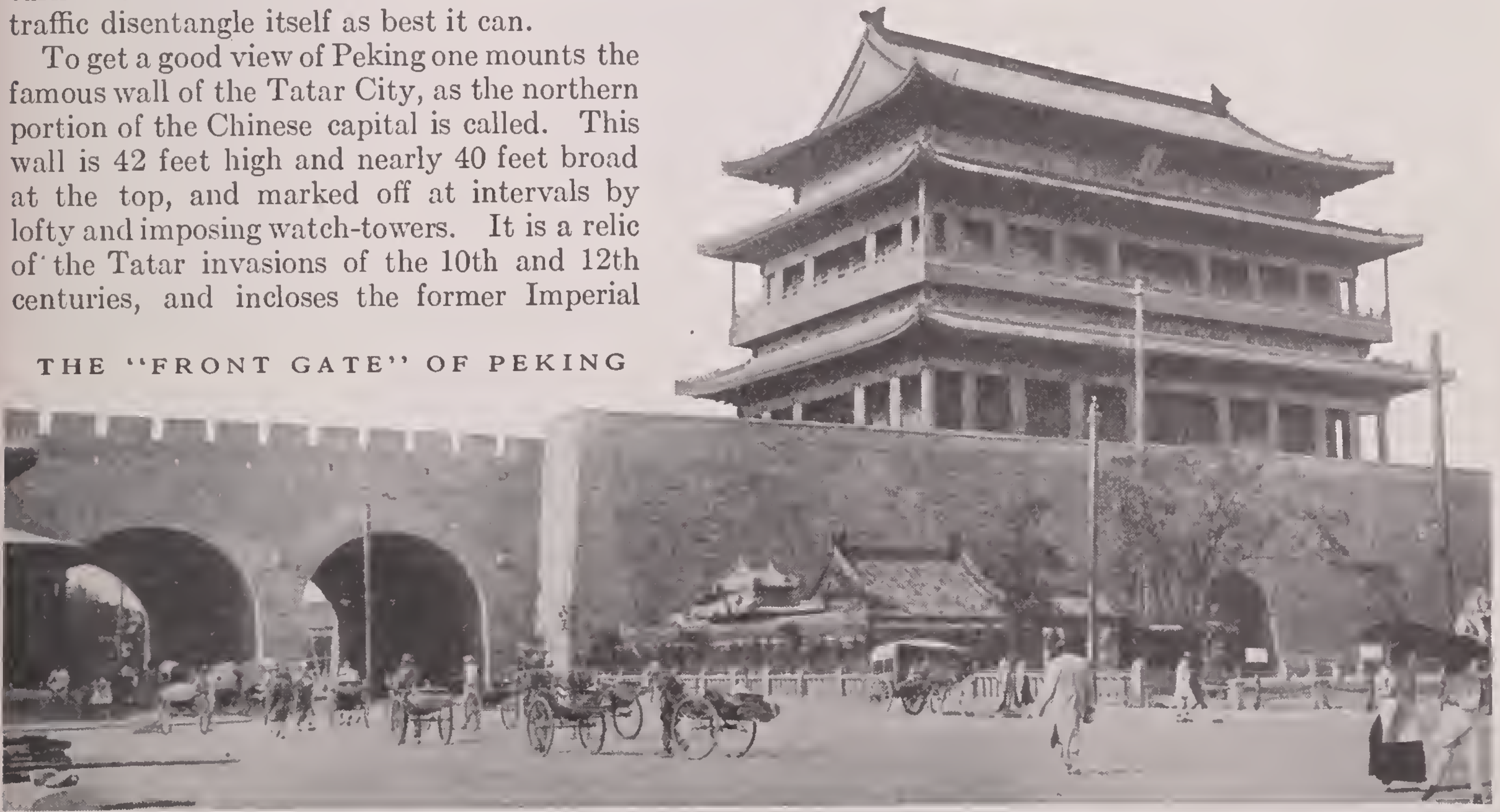
South of the "Tatar City" is the so-called Chinese City, enclosed by a 30-foot wall, built in 1543. Thus Peking is a double city, with an area of about 25 square miles and a circumference of 30 miles.

From the top of the Tatar wall one sees innumerable Buddhist temples and old palaces peering out from groves of trees, in contrast to the low huddled houses in the more crowded quarters. The red, blue, or yellow tiles of the gracefully curving temple roofs put gorgeous splashes of color into the scene, while a touch of silver from some lotus pond flashes in the background.

A better view of the Forbidden City can be obtained from Prospect Hill, an artificial mound 150 feet high topped by five summits, on each of which stands a temple. Near by are the crumbling palaces and homes which housed the former emperors and their courts. Gracefully arched bridges of white marble lead over the flower-bordered pools which dot the parks, and everywhere the oriental love of delicate decorative details is in evidence. Today the president of the Chinese republic occupies the quarters which before the revolution of 1911 were held sacred to the Son of Heaven, as the emperor was called.

In the Chinese City, the most notable building is the Temple of Heaven, with its huge altar, where for five centuries the emperors prayed to Shang-Ti, the Supreme Being or God of Heaven. But more interesting than ancient palaces or temples is a trip through

THE "FRONT GATE" OF PEKING



The famous Chien Men or "Front Gate" pierces the great wall of the Tatar City on the south side. You can see from this picture the amazing thickness of this wall. The structure rising above the wall on the right is one of the "towers" which formerly housed the imperial troops guarding the wall.

A MODERN BUSINESS STREET AND AN ANCIENT TEMPLE

This is one of the few paved streets in Peking. Most of them are unpaved and undrained, and are little more than mud tracks varied by occasional heaps of garbage and foul-smelling pools.

the crowded bazaars. Furs of tiger, leopard, and wild cat are offered for sale, along with costly embroideries and brocades, jade and porcelain wares, strange candies and sugared fruits—all mingled in indescribable confusion. Such bazaars are for the Chinese themselves, and Europeans are not wanted there. The white men have their own shops, hotels, clubs, newspapers, etc., centering mostly in the Legation Quarters of the Tatar City.

Peking's environs also are full of interest. Eight miles away is the famous summer palace of the former imperial family. The grounds are a fairyland of artificial mountains over which wind intricate pathways and miniature streams and waterfalls. A short railway journey will take the traveler to the Nankow Pass in the Great Wall, through which passes most of the trade between Mongolia and China. In a picturesque, hill-encircled valley, two hours' journey by donkey from Nankow, are the Ming tombs. An avenue three miles in length leading to this ancient burial place of the emperors of the Ming dynasty is lined with large images carved from solid blocks of marble, representing lions, elephants, camels, horses, military officials, and sages. A trip to Chung Hua, some 20 miles from Peking in another direction, brings one to the Indemnity College. There American teachers and a native faculty prepare Chinese students for study in America on scholarships founded with the indemnity returned by the United States government after the settlement of the Boxer troubles.

This is the altar of prayer for good harvests, a part of the Temple of Heaven. The roof is made of porcelain tiles of an exquisite deep blue color.

Although Peking is the center of a large Chinese trade, it is not industrially important. Most of the articles imported are for local consumption. Most of the commerce with the outside world is carried on by railway through the great seaport of Tientsin, 70 miles to the southeast, and through Mukden in Manchuria, 400 miles to the northeast on the Trans-Siberian railways. The trade with southern China passes up and down the famous Grand Canal, which runs 800 miles south from Peking to Hangchow. Population, estimated at from 700,000 to 1,000,000.

PELICAN. Mr. and Mrs. Pelican feed their babies from a cupboard which they carry about with them. This cupboard is a sack of elastic skin grown from the under side of the beak. It is often six inches deep and a foot and a half long and it will stretch until it is large enough to hold several quarts of fish or other food. Some species of pelicans use this sack-cupboard also as a fish net, scooping fish into it through their wide-open bills, as they swim along on the water.

To see the old birds feeding their young is one of the most ludicrous sights in nature. The parent opens wide its great beak, and the little pelican sticks his head inside and helps himself to the contents of the pouch. As the young grow larger they are able to penetrate farther and farther for their meals, until you see one of them with his whole head and neck far within the parent bird's capacious maw, eagerly pushing farther and farther with successive jerks, until you wonder if he is not going to disappear entirely!

There are about 20 species of these grotesque water birds, found in temperate and tropical regions. The larger varieties are about five feet long with wings that sometimes span ten feet. The neck is strangely bent, the four toes are connected by a web, and during the mating season the male bird wears a bony lump on the top of his beak, which quite disappears with the fall molting. Except the spotted-billed pelican of Asia, which nests in tall trees, these birds nest on low bushes or on the ground, where the two or three large coarse-shelled eggs, as well as the fledglings, are often destroyed by floods.

WHITE PELICANS, OLD AND YOUNG

The Pelican is an ungainly bird on land, but in flight is extremely graceful. You can see how its great beak pouch is contracted when not in use.

BIG FISHERMAN AND LITTLE THIEF

A Laughing Gull will frequently follow the Brown Pelican when the latter goes fishing. The Gull waits until the Pelican has captured its prey, then alights on the great beak. As the Pelican opens its mouth to swallow, the Gull snaps up the fish and flies away.

The most remarkable species is the roseate pelican of southern Europe. Its white plumage is beautified by a blush of rose or salmon color, which passes into yellow on the crest and front neck.

America is the home of the white pelican. Though once it was common throughout the eastern states, it is now rarely seen east of the Dakotas, so showy a bird having proved too great a temptation to hunters. Now, however, pelicans are protected by law, and their favorite breeding places have been made government reservations.

The brown pelican also is a native of America, and is found on the Atlantic coast in South Carolina and farther south. Sometimes it is seen in Iowa, Illinois, and even as far north as Nova Scotia. Pelican Island in Indian River, Fla., is a government reservation and there each year, during the nesting season, these birds may be seen by the thousands. (For illustration in colors, *see* Birds.)

The pelican family, *Pelecanidae*, belongs to the order *Steganopedes*. Scientific name of white pelican, *Pelecanus erythrorhynchus;* of brown pelican, *Pelecanus occidentalis.*

PEN. When an ancient Roman wrote a letter he inscribed the words on the wax-smeared surface of thin boards or tablets with a pointed bone or metal stylus. For books and other writings intended to be preserved, the scribe wrote on sheets of papyrus or parchment with a split reed pen (*calamus*). The reed pen, which is used to this day in Persia and some other Eastern countries, was the ordinary writing implement in Europe until the introduction of paper made finer pens necessary and quill pens came into use. The quills were taken from the wing of a large bird, usually a goose or swan; and quill pens are still occasionally used. The quill gives us our word "pen" (from the Latin *penna*, "feather") and the term "penknife," which is still used to mean a pocketknife, is a reminder of the days when the pocketknife was used to mend quill penpoints.

WRITING ON PAPYRUS WITH A REED

The ancient Egyptians wrote with a reed called "calamus," which they cut into short lengths and sharpened to a point. In many parts of the East, reed pens are still in use by the natives.

Experiments were made in the manufacture of steel pens late in the 18th century. A pen-maker named Wise produced steel pens in 1803, but they were not satisfactory. Joseph Gillot of England made a successful steel pen in 1820. John Mitchell used machinery in making pens in 1822. James Perry started making steel pens in 1824, and manufactured the first "slip pens" about 1828. Not until about 1860, however, was the manufacture introduced into the United States. Steel pens are now made in as many as 2,000 distinct styles. The great center of pen manufacture is at Birmingham, England, although the factories of the United States turn out nearly 3,000,000 gross of pens a year—more than four pens for every man, woman, and child.

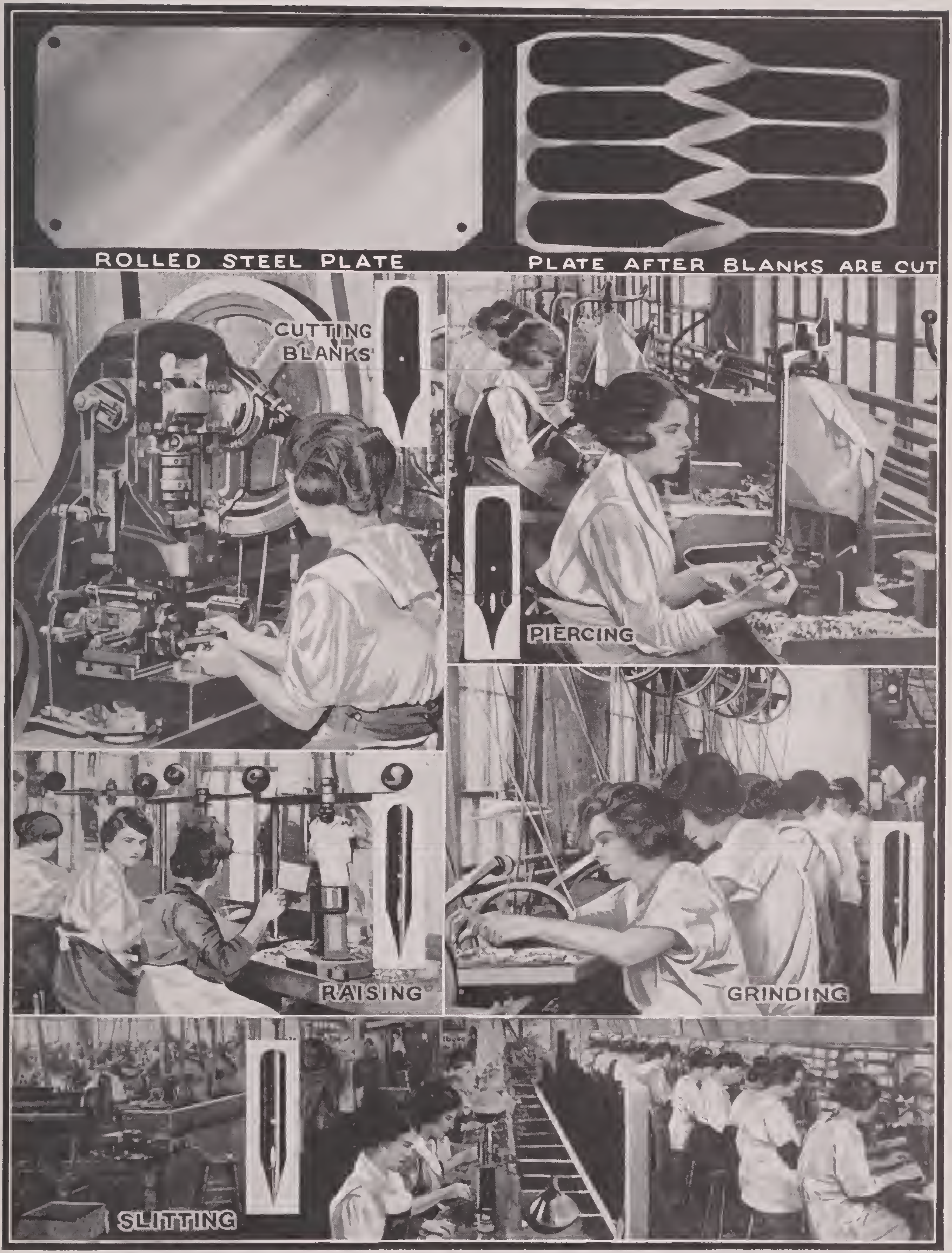
ANCIENT MANUSCRIPTS WRITTEN WITH QUILLS

For more than a thousand years, a period when almost all writing was done by monks, the quills of geese or swans were used. In the 18th century, quills were improved by hardening, usually by dipping in a boiling solution of alum. One of these pens is shown at the left.

The pens are made of the best steel, which is brought to the factory in sheets about $\frac{1}{40}$ of an inch thick—about three times as thick as the finished pen. These sheets are cut into strips just wide enough so that two pen "blanks" with points interlapping can be cut from them. Then the strips are heated cherry red and slowly cooled to soften the metal. Rollers stretch the strips out until they reach the required thinness, and then machines stamp out the pointed blanks at a rate of many thousands an hour. The manufacturer's name is then stamped on, the central hole for holding the ink is punched, and finally the blanks, which so far have been flat like tiny fence palings, are curved into the familiar pen shape. They now look complete except for the slit down from the ink hole to the point, but the steel is soft and inelastic. A perfect pen, as we know, must be so tough and springy that it opens and closes thousands of times without losing its shape. So the points have to be hardened by heating and dropping into cool oil, and tempered in cylinders that revolve over a fire. Then they are finished for market.

Gold pens, which were first made in England about 1808, have to be tipped with iridium to keep the soft metal from wearing away. They are used chiefly in fountain pens, which have grown steadily in favor since their first extensive manufacture in England in 1835; but regularity in the flow of ink

HOW A MODERN STEEL PEN IS MADE



The flat blanks are first stamped out by machine. Machines also cut the little hole which holds the ink, and the two side or shoulder slits which give flexibility. The pen must then be annealed before it is "raised" or rounded between two dies; next the point is ground on emery wheels; and finally, after being tempered, the point is split by a special machine of very delicate construction. A final polish, a little lacquer on the tip to prevent rust, and the pen is ready for market.

was first achieved by patents granted to L. E. Waterman in 1884. The modern type of fountain pen has an ink reservoir which keeps the point always supplied, and which can be filled either with a special filler or automatically by drawing the ink up through the point. The barrel is made of vulcanized rubber. Nearly 8,000,000 such pens are manufactured every year.

The stylographic pen is also a reservoir pen, but in place of a gold pen it has a blunt-pointed needle or stylus in the tip, which also serves as a valve in regulating the flow of ink.

PENCIL. If you use your share of the lead pencils manufactured in the United States, you use eight every year. In other words, it takes about three-quarters of a billion of pencils a year to supply the country. To get some idea of what this prodigious number means, imagine all the pencils laid end to end as they stream from the factories. In one year they would form a line long enough to extend three and a half times around the earth!

Think of the forests of timber that are cut down to supply the wood for all these pencils! The only really satisfactory wood for the purpose is the soft, rather "cheesy" red cedar, but the American supply has been so drawn upon that now this wood has become exceedingly scarce. Attempts are being made to grow it under cultivation, and buyers have gone through districts where red cedar was formerly abundant and bought cedar stumps and old rail fences and log cabins made of it. Because of this shortage of cedar wood, many of our pencils are now made with a cover of paper strips wound spirally and glued, so that the pencil can be sharpened by unrolling the paper in strips. Cheap pencils are also cased in poorer kinds of cedar and other woods.

"Lead" pencils, we call them, but the pencils of today do not contain lead, but graphite (*see* Graphite). Until well into the 19th century, however, lead was used for this purpose, and the name still sticks. Chalks, colored earths, and lead have been used for marking and drawing ever since the days of the Romans. The introduction of graphite for this purpose began in England in the last half of the 16th century. The black mark of the graphite made such a contrast to the pale line of the lead that it was called "black lead."

At first, pencils were made by pulverizing the graphite, compressing it into solid blocks, and cutting tiny bars from these blocks and enclosing them in cases. But since 1795 clay has been mixed with the graphite to produce leads of various grades of hardness; the more clay, the harder the pencil.

Sometimes a little lampblack is added to increase the blackness. The thick doughy mixture is then squeezed by hydraulic pressure through perforations in a plate until it is smooth enough, and finally through a perforation the size of the finished lead. As the long black strings coil up like a wire on the board below, they are nipped off into pieces of the right length, straightened out, and allowed to dry. After drying, the pieces are packed into trays, sprinkled with carbon dust, and baked for several hours until all the moisture has been extracted.

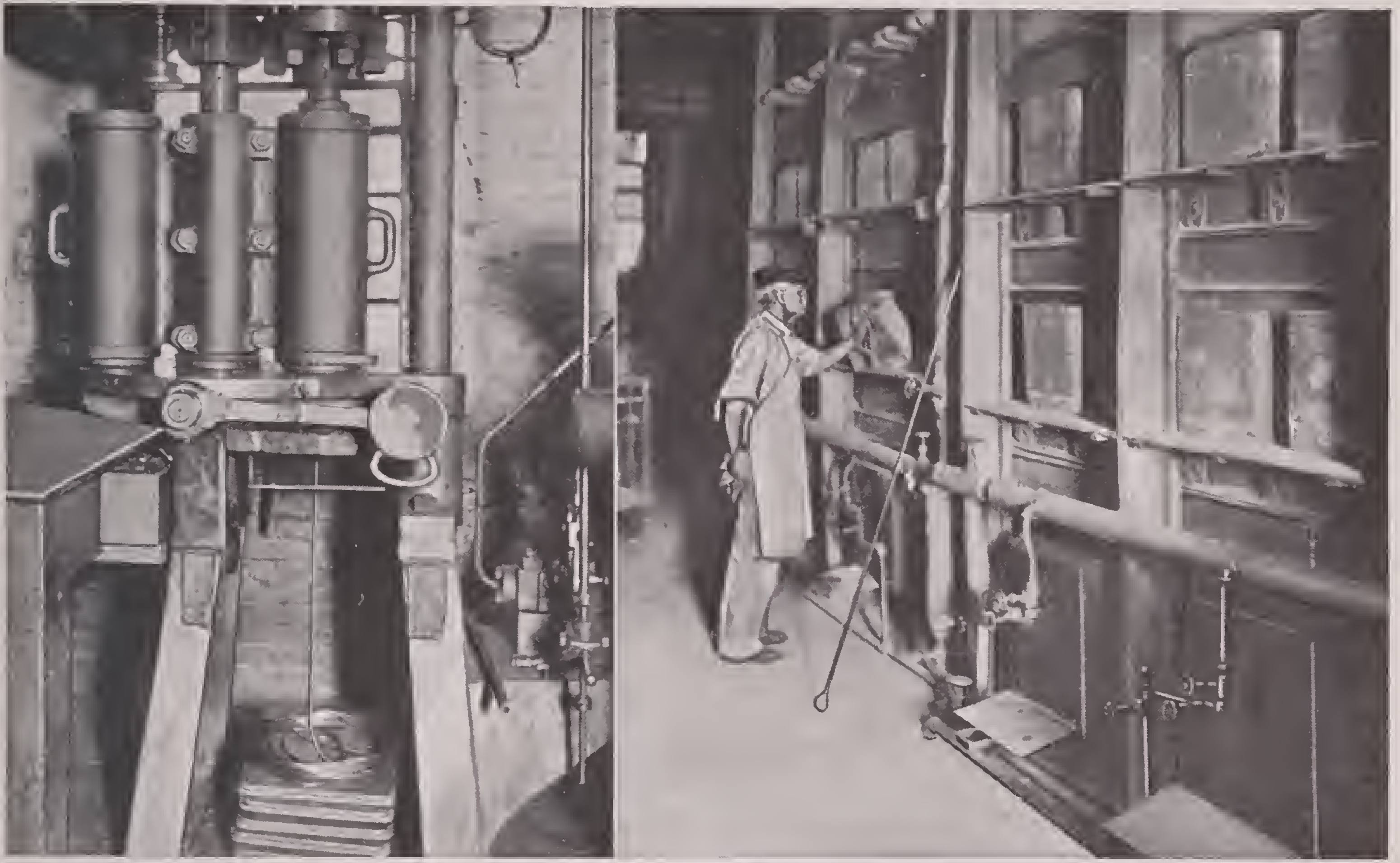
The leads are now ready for the cases, which are made by milling the wood into little "slats" 7 inches long, 2 inches wide, and ¼ inch thick, and cutting six little grooves in them just big enough to hold the leads. The leads are slipped into place, and a cover slat is glued on and clamped. When these "blocks" have dried sufficiently a shaping machine mills each of them into six perfectly formed pencils, which are stained, varnished, labeled, supplied with tips and rubbers, and boxed, all by machinery.

Colored pencils are made by mixing chalk, clay, or wax with coloring matter. Carpenters' and markers' pencils, which are very soft, have a little wax and tallow added to the graphite. A popular form of magazine pencil has a casing of metal, and a lead that is allowed to slip forward at the point as needed.

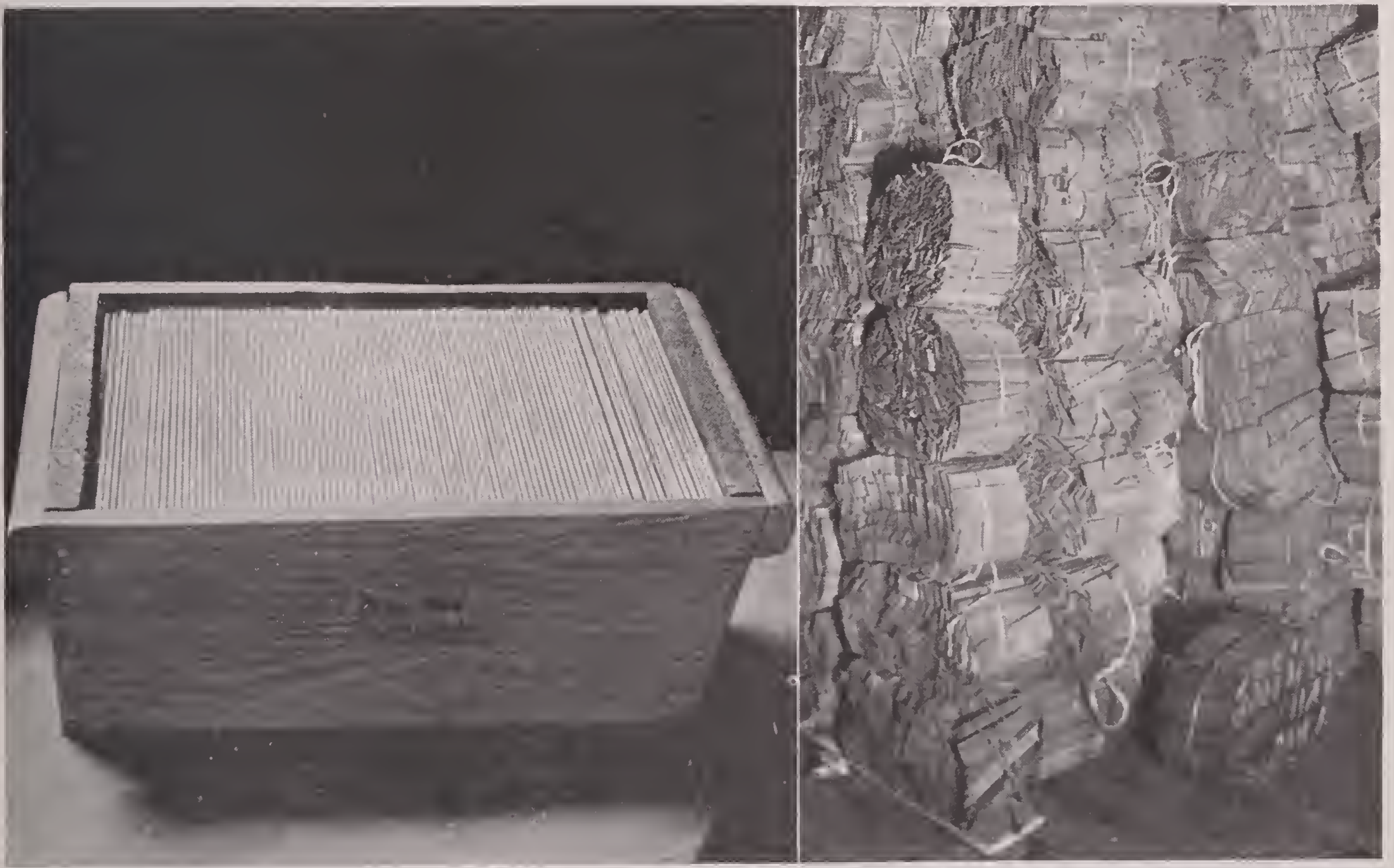
THIS IS WHAT DOES THE WRITING

Graphite has to be purified before it can be used in pencils, for in its raw state this form of carbon is usually mixed with other minerals. After being ground and purified, the graphite is pressed into slabs like this.

HOW PENCILS ARE MADE—PREPARING THE "LEAD"

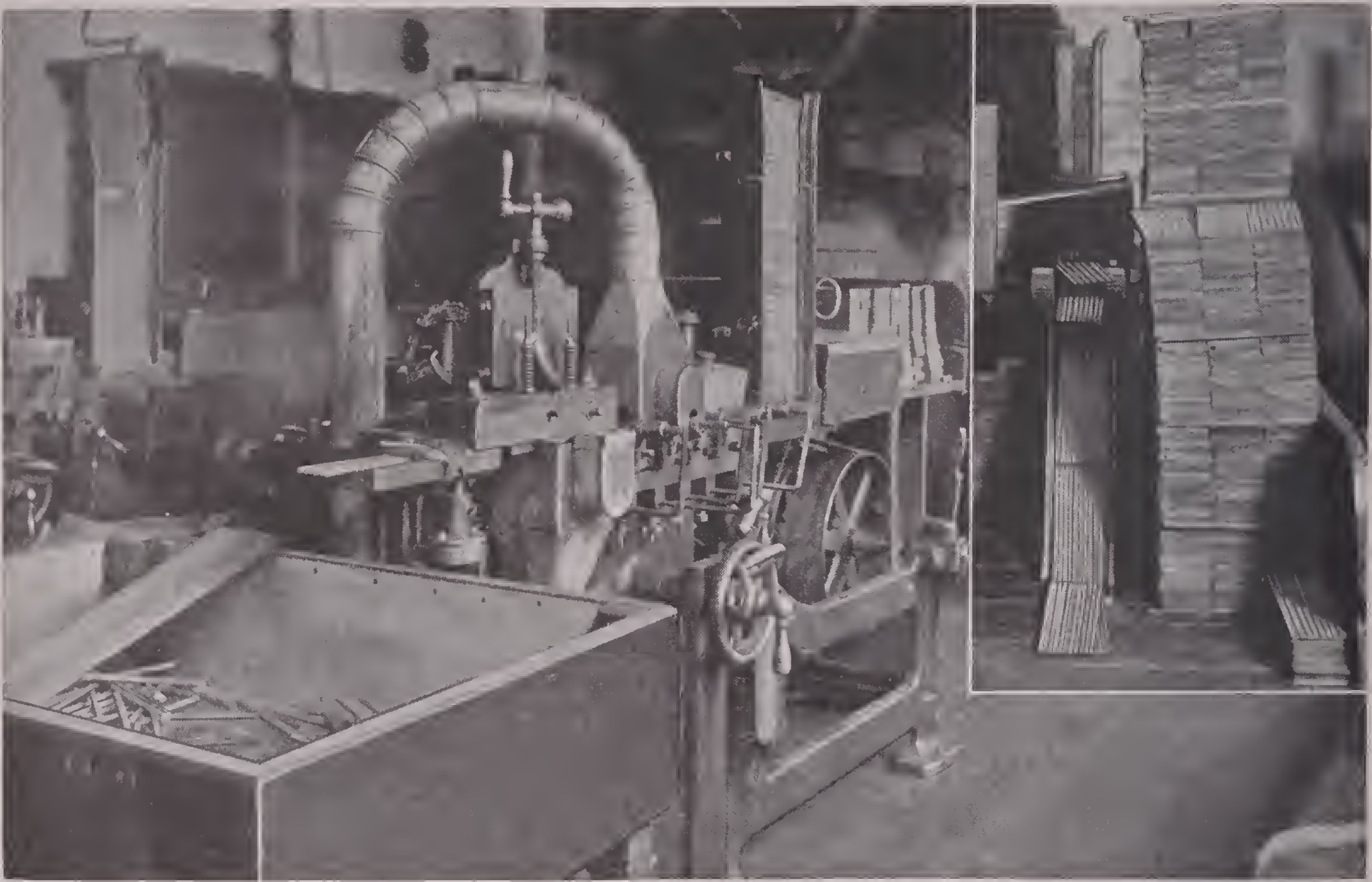


These two pictures show the processes which make the "lead." Purified graphite, clay, and lamp black are mixed into a dough, and the dough is fed into the machine at the left. This machine forces the dough through holes in one plate after another, each hole being smaller than the one preceding. The "dough" emerges from the last hole as a string of the desired thickness. The string is cut into proper lengths. Then the pieces are straightened and baked for several hours in the ovens shown in the right-hand picture.



At the left is a box of baked leads, ready to be made into pencils, and at the right are the bundles of wooden slats from which the covering for the leads will be cut. Each slat has been carefully sawed out to a size which will yield exactly the desired number of "casings," so that there is very little waste in trimming.

PUTTING THE LEADS INTO CASINGS



These two pictures show how the leads and the wood are put together into pencils. In the smaller picture in the upper right-hand corner, the wooden slats are passing through a "grooving machine," which cuts channels just large enough to receive the leads. The grooved slats and leads are then fed into the machine shown in the larger picture. There the grooved sides of two slats are glued together, with leads enclosed, and then the slats are split into separate pencils. These are trimmed down, either round or hexagonal, as desired, and the pencils are delivered to the large box at the extreme left. You can see the pencils made from one set of slats emerging from the left end of the machine.

After the pencils have been trimmed to their proper shape they are ready for the final touches. The wood must be polished or varnished, the name and number of the pencil are stamped at one end, and perhaps metal caps for holding erasers are fastened on.

PENDULUM. The "life" of grandfather's tall clock was the pendulum. Such a clock, in fact, was only a pendulum with a mechanism attached to indicate the seconds, minutes, and hours as the pendulum ticked them off, and a weight or spring which gave the pendulum a little push at the end of each swing to keep it going.

There are several interesting and important things about a pendulum, which may be defined as a comparatively large and heavy weight so hung from a fixed point that it is free to swing. First, within a small arc, each swing of a pendulum takes just as long as every other swing, longer or shorter. This fact—the *isochronism* of the pendulum—was discovered by that remarkable man Galileo, as you may read in the article which deals with him.

Further, the time of oscillation varies with the length of the pendulum, as you can see for yourself by swinging a plumb bob at the end of strings of different lengths. Perhaps you have seen an old-fashioned clock regulated by raising the pendulum bob to make it go faster or lowering it to make it go slower. The length of a seconds pendulum (one which ticks once a second) is about 39 inches.

Since most substances expand with heat and contract with cold, a clock with an ordinary pendulum goes faster in cold weather (when it is shorter) than in warm weather (when it is longer). Different substances, however, expand at different rates, and thus it is possible to make a "compensating pendulum" in which the bob is raised by the expansion of one metal and lowered just as much by the expansion of another. In the mercury compensating pendulum, the weight is a jar of mercury so adjusted that the rise of the mercury in the jar exactly makes up for the lengthening of the steel rod. Within recent years an alloy of steel and nickel, called "invar," has been discovered which does not appreciably change length with temperature change; and many fine astronomical clocks now have pendulum rods of invar.

Why does a pendulum swing? Briefly, because gravity keeps pulling on it. Since the force of gravity varies at different points on the earth's surface (*see* Gravitation), the time of oscillation of a given pendulum will likewise vary according to latitude and height above sea level. The pendulum is therefore one of the best possible measures of gravity, and the pendulums used for the purpose by the United States Coast and Geodetic Survey are marvels of precision. The probable error in measuring the force of gravity with them does not exceed 1 in 200,000.

PENGUIN. Seen from a distance, a colony of these strange sea-birds of the Southern Hemisphere might easily be taken for an assemblage of little men. They stand erect and flat-footed, often drawn up in long regular files, like soldiers, and they walk with a tread so stately and dignified that the sight is irresistibly comical. In the species known as the king penguin, the resemblance to man is heightened by the coat of grayish-blue which covers the back, set off by the black plumage of the head and the white of the breast, with yellow cravat at throat.

OUT FOR A WALK

This is a King Penguin mother escorting her young son on a stroll over the rocks.

LIKE A GROUP OF ALPINE TOURISTS

Here is a group of Black-throated Penguins, standing about on the edge of an ice floe, as though they were gazing upon the scenery. Their upright position, waddling walk, and arm-like wings, make them seem like so many fat, solemn little men.

The penguin looks more like "a caricature of a big fat human being than an ordinary diving bird," says the celebrated naturalist William Hornaday; and it was this ludicrous resemblance to mankind that led Anatole France, the great French novelist, to write his famous story 'Penguin Island'. In this he tells of a snow-blinded missionary who was driven by a storm to a remote shore. Upon landing he was surprised to find, as he supposed, the inhabitants assembled to meet him. As they stood about him, he preached to them, and interpreting their nodding and bowing as signs of assent, he performed the rites of baptism upon them. Great was the surprise of the good man when he later discovered that he had been speaking to a colony of penguins!

A TRAGI-COMEDY IN THE ANTARCTIC

Of all egg-stealers, undoubtedly the worst robber is the Sheath-Bill, an Antarctic bird which haunts the rookeries of Penguins and Shags. Here you see two Sheath-Bills getting a meal at the expense of a poor Emperor Penguin. One of the Sheath-Bills annoys the Penguin, who reaches forward to attack, thus leaving her nest unprotected. The second makes a thrust at the egg with its sharp beak, and the two thieves triumphantly march away with their booty, while the simple-minded Penguin is apparently still unconscious of her loss.

This story might seem more plausible if the fossil penguin of prehistoric ages, which stood 6 feet high, were still in existence. The largest penguins of today, which belong to the emperor penguin species, stand about 3½ feet high, but they weigh about 80 pounds.

Ages ago the penguin could fly as well as any other sea-bird, but today its wings are short paddle-like flappers, entirely useless for flight. Since the bird inhabits only remote lands, in or near the Antarctic regions, where it has few human or animal enemies, it came to spend all its time on land or in the water. Generation after generation it failed to use its wings for flying, and so in the course of long evolution those wings became very small and stiff and lost their long feathers, until now they cannot be moved at the middle joint like the wings of flying birds. But the penguins became wonderful divers and swimmers, using their wings one after the other as a man paddles a canoe with a double paddle, and steering with their feet. They also developed a very thick coat of fat to protect them from the intense cold of the regions where they live. This fatty layer may finally lead to the extinction of the penguin, like the great auk of North America, unless it is protected by laws; for hunters now kill the birds in enormous numbers and boil them down for oil. Fish is the penguin's chief food, so the fat and oil have a disagreeable fishy flavor.

The haunts of these birds are the islands of the Pacific and Antarctic oceans, and the rocky coasts of New Zealand, Australia, and parts of South America. There they nest in great colonies and from their nesting places is collected some of the fertilizer called guano.

The eggs of the penguin are of a chalky white or greenish color. The baby birds are hatched blind and require care for an unusually long period before they take to the water. The grown birds bite savagely when molested, but they show little fear of man since for untold generations they have lived in regions where human beings are rarely seen.

Because their wings are useless as organs of flight, penguins are regarded by some naturalists as forming a distinct super-order of birds called *Impennes* (wingless). They belong to the family *Spheniscidae*. Scientific name of emperor penguin, *Aptenodytes fosteri;* king penguin, *Aptenodytes patagonica.*

PENN, WILLIAM (1644–1718). The despised and persecuted sect of Quakers were greatly elated when William Penn, the talented young son of Admiral Penn, became an open convert to their religious views, taking so prominent a part in their demonstrations that he was expelled from Oxford where he was then a student. At first the admiral stormed at his son, for King Charles II was about to raise the elder Penn to the peerage but drew back when he heard that the son had become a Quaker. The father's anger, however, was short-lived; he soon forgave him, and the rich and highly placed William Penn became the most prominent Quaker in England.

Likewise, William Penn became the most famous of all the colony-builders of America. His province of Pennsylvania (or "Penn's Forestland") was a princely domain of 40,000 square miles, which the king granted to him in 1680, in payment of a debt owed by the Crown to Admiral Penn, and which William had now inherited through the death of his father. William Penn had frequently suffered persecution and imprisonment for his religion in England. Neither could he nor his fellow-sufferers find a place of refuge in any of the established colonies of America, for the Quakers were regarded as undesirable citizens. It was, therefore, to found a haven for people of all creeds or of no creed that Penn in 1680 sent out the first settlers to his colony of Pennsylvania.

Although the power to make laws, establish courts, and otherwise regulate the affairs of the colony was conferred upon Penn by the king, he established a popular government, giving to the people the right to elect an assembly which should make their own laws.

Penn's most conspicuous success was in his dealings with the Indians. The story of his famous treaty with them, made under a great elm tree on the banks of the Delaware River, is known to all. By this treaty he purchased from the red men the land included within his grant, and they agreed to "live in love with William Penn and his children as long as the sun and moon give light." Although there were no written words, this sacred treaty was kept unbroken till long after those who made it had passed away, and Pennsylvania was thus freed from the danger of Indian wars which beset less just and less fortunate commonwealths.

WILLIAM PENN
Founder of Pennsylvania

Penn had established a home in Philadelphia, the capital of his colony, and there he would gladly have spent the remainder of his life; but after two years in the colony he was called back to England by business and was detained there for 15 years.

After the Revolution of 1688, which brought William and Mary to the throne of England and Scotland, Penn was suspected of giving aid and comfort to the dethroned James II, and was once arrested for treason. In 1692 he was deprived of his colony, but two years later, the charges against him having been dismissed, he regained Pennsylvania. In 1699 he revisited his province.

Vast changes had taken place during his absence. Twenty thousand people now inhabited the province. Many of them knew nothing of William Penn except that he owned their colony and possessed rights which they wished to exercise. They demanded an even more democratic government than Penn had given them before. He granted their request, and the charter which he conferred upon them in 1700 remained in force for 75 years—until the War of Independence

In 1701 Penn bade a final farewell to Pennsylvania, and sailed again for his native land. His was a sad homecoming, for on reaching England he found that he had been robbed of the remainder of his fortune by a dishonest steward, and to avoid further extortions he allowed himself to be thrown into prison for debt. He was finally released by his friends, but not until his health was permanently imperiled. The remainder of his life was troubled by quarrels with Lord Baltimore, the proprietor of Maryland, by disagreements with the people of his province, and by the dissipations of one of his sons. He was making arrangements to surrender his colony to the Crown when he was stricken with paralysis; and so Pennsylvania became the property of his descendants. Their rights, except to private estates, were sold to the Commonwealth of Pennsylvania during the Revolutionary period.

William Penn was the author of a number of works, among which the chief were: 'No Cross, No Crown', a work of Christian piety; 'The Great Case of Liberty of Conscience', an able defense of religious toleration; and 'The Present and Future Peace of Europe', a work which may be said to have foreshadowed the Hague Tribunal and the League of Nations. His 'Fruits of Solitude', a treasury of wise maxims on life and conduct, is still widely popular.

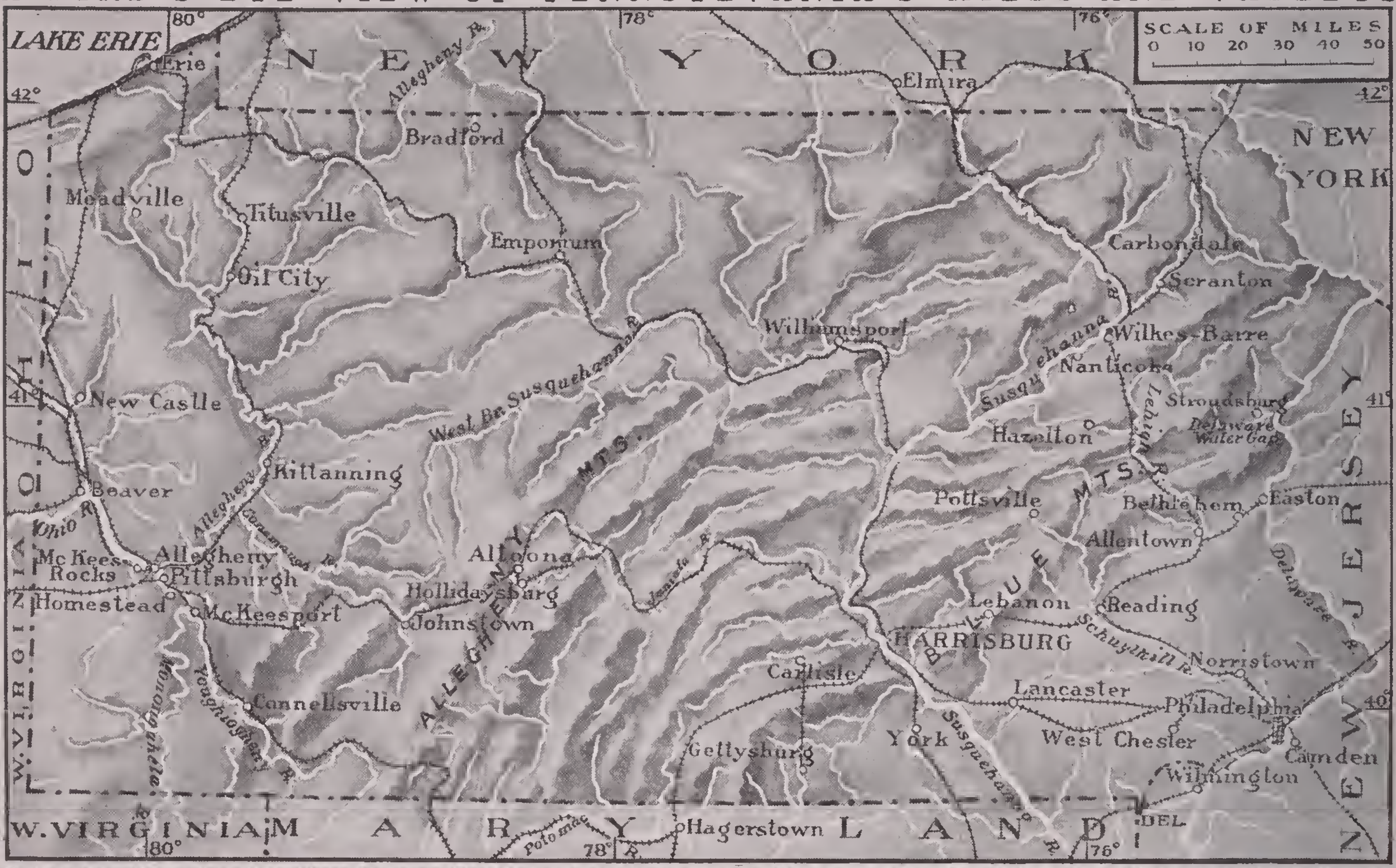
The KEYSTONE STATE, *a Titan of* INDUSTRY

PENNSYLVANIA. The name "Keystone State" was given Pennsylvania long ago because when the Union was formed it was the "keystone" of the arch, six states lying to the south of it and six to the north. It still remains the Keystone State, not merely because of its geographical location, but because of its political importance, its immense natural resources, its vast industrial development, and its great population (second only to that of New York).

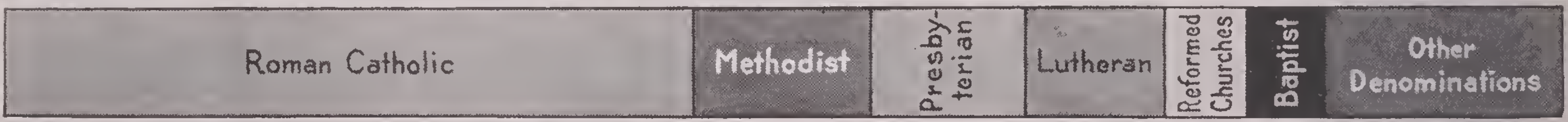
Extent.—North to south, 158 miles; east to west, 302 miles. Area, over 45,000 square miles. Population (1920 census), 8,720,017.
Physical Features.—Blue Ridge and Allegheny Mountains (Blue Knob, 3,136 feet); Allegheny plateau sloping to the west. Principal rivers: Delaware, Susquehanna, Ohio (Allegheny and Monongahela).
Principal Products.—Iron and steel (pig iron, structural steel, locomotives, and machinery), textiles (silks, woolens, hosiery and knit goods, cotton goods), leather and leather goods, clothing, chocolate and cocoa, petroleum products; coal, natural gas, petroleum, cement, and clay; hay, corn, wheat, live stock.
Chief Cities.—Philadelphia (about 1,825,000), Pittsburgh (590,000), Scranton (140,000), Reading (110,000), Harrisburg (capital, 76,000).

The largest of the Middle Atlantic states after New York, Pennsylvania is shaped roughly like a great parallelogram, 302 miles in length by 158 in breadth. The only parts of its boundaries which are not straight lines are the Delaware River on the east, the arc which constitutes the northern boundary of Delaware, and the slanting shore of Lake Erie which bounds the northwestern extension of the state. None of the Atlantic states has a surface more varied or in which the outer ranges of the Appalachian system, extending from northeast to southwest, are more widely separated. From east to west Pennyslvania is 302 miles long and from north to south 158 miles.

A BIRD'S-EYE VIEW OF PENNSYLVANIA'S HILLS AND VALLEYS



Notice how the railroad builders have profited by nature's engineering; the principal routes follow the valleys carved out through the mountains by the rivers ages ago. The strip below shows the religious divisions of the state.

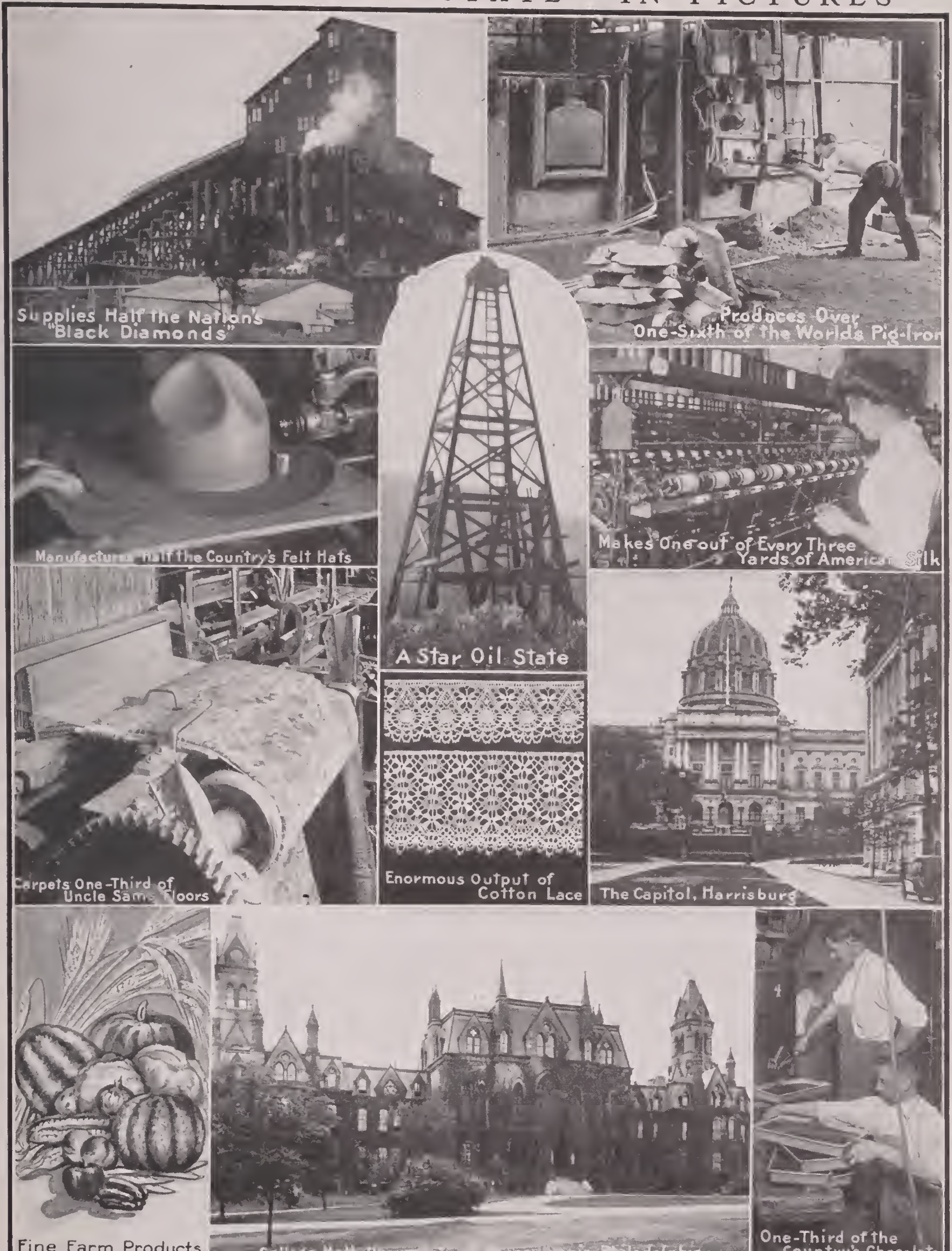


Four distinct divisions of the state's surface may be noted. The first, the Piedmont Belt, includes that part of the state between Delaware River and the Blue or Kittatinny Mountains. The second and third divisions, the Appalachian Mountains and the Great Valley, lie wholly within the main Appalachian system. Throughout this region are found many rugged mountain walls forming gaps or narrows. The Susquehanna and the Delaware break through this chain. The Delaware, cutting diagonally across the Appalachian system, forms the famous Delaware Water Gap. In this division is found also the famous Mount Pocono region, now a summer playground for hundreds of tourists. The fourth division begins a little west of the center of the state, and consists of a series of high, rolling table-lands or plateaus known as the Allegheny Plateau. The entire western section of the state, from 1,000 to 1,500 feet above sea level, is everywhere broken by short, fertile river valleys. Blue Knob in Bedford County, with an altitude of about 3,136 feet, is the highest point in the state.

Although only thirty-second in size among the 48 states, Pennsylvania is larger in area than a dozen of the sovereign nations of the earth before the World War. And of its people a writer in the *National Geographic Magazine* says strikingly: "One might add the populations of four far western states to that of all New England and still have fewer people than dwell in the land of William Penn. If you extended the western boundary of the Dakotas to the Rio Grande, all of the people who live between that line and the shores of the Pacific would barely equal Penn-land's population. The state is distinguished for its great numbers of foreigners. No other state has so many Welsh, Austrians, or Hungarians. It has more Welsh than County Radnorshire, more Austrians than the province of Salzburg, more Hungarians than any two cities in Hungary, Budapest excepted. It has as many English as the counties of Cambridge and Oxford together; as many Irish as County Kerry; as many Scotch as County Clackmannan; as many Russians as the government of Kharkov." Yet in spite of this large foreign labor element, Pennsylvania still ranks very high in the number of inhabitants of native parentage. If the whole United States were as densely populated as Pennsylvania, it would have a nation of half a billion more people than the entire continent of Europe.

The industries of the state, which are the chief cause of Pennsylvania's population, are a marvel of human energy. This commonwealth, which contains but one-twelfth of the people of the United States, produces one-eighth of the republic's manufactures and more than a fourth of its minerals. And although

THE "KEYSTONE STATE" IN PICTURES

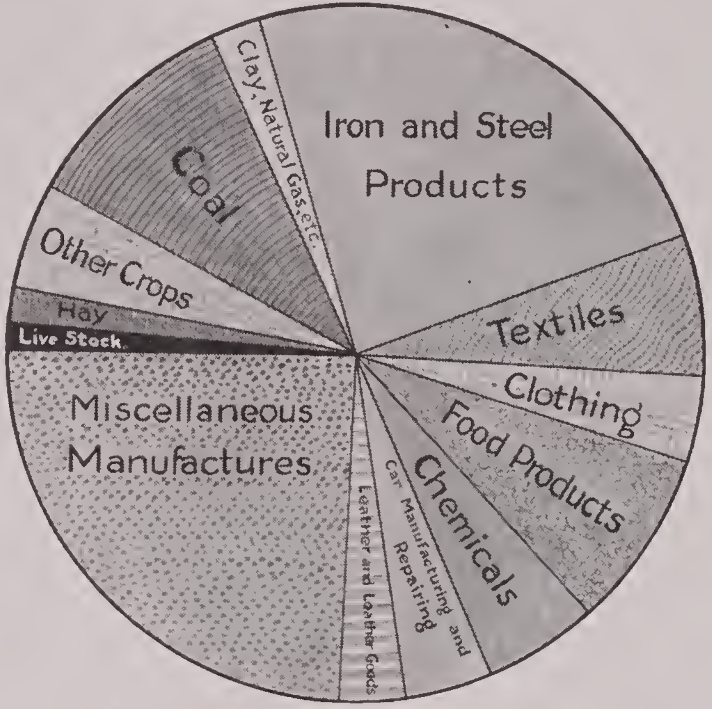

Supplies Half the Nation's "Black Diamonds"
Produces Over One-Sixth of the World's Pig-Iron
Manufactures Half the Country's Felt Hats
A Star Oil State
Makes One out of Every Three Yards of American Silk
Carpets One-Third of Uncle Sam's Floors
Enormous Output of Cotton Lace
The Capitol, Harrisburg
Fine Farm Products
College Hall, University of Pennsylvania, Philadelphia
One-Third of the Country's Chocolate

These pictures show several of the leading industries of Pennsylvania. In coal, hats, oil, iron and steel, lace, chocolate, and many other products, the humming mills and factories of the Quaker state dominate the American market. The Capitol at Harrisburg is one of the finest in the Union and the University of Pennsylvania boasts a long and glorious history. While Pennsylvania is generally known as a manufacturing state, its farm products form a considerable portion of its wealth.

Pennsylvania has only one-half of one per cent of the earth's total population, it produces about 16 per cent of the world's pig iron and the same proportion of its coal!

Yet Pennsylvania is far from being merely a crude iron and coal state. It has a greater diversity of industries than any other state, excelling in this respect both New York and Illinois. The same writer who was quoted above says: "This versatile geographic Titan forges the heaviest castings civilization has ever undertaken to make, and the most delicate micrometers that science demands for traversing the realms beyond the millionth of an inch. With equal success it builds tremendous testing machines that squeeze metals to the tune of millions of pounds, and makes watches whose balance-wheels measure time down to the hundred-thousandth part of a second. Someone has observed that Pennsylvania bridges span most of the rivers of the earth, and that Pennsylvania locomotives run over Pennsylvania rails in the Occident and Orient alike, across Arctic wastes and through tropical jungles, through the heart of civilization and on the border of savage lands. The state makes nearly half of the country's cotton lace, more than a third of its carpets and rugs, more than a third of its chocolates and cocoa, nearly half of its felt hats, and more than a third of its silk. It produces more asbestos products than all the rest of the country, and more bluing, ice-cream, hammocks, and leather than any other state represented on our starry flag." With these extensive and varied industries, it is not surprising that Pennsylvania ranks as the second manufacturing state of the Union, being surpassed in the annual value of its products by New York alone.

PRODUCTS OF PENNSYLVANIA



Its coal and iron are the foundations of Pennsylvania's industrial eminence, but the state stands well to the top in nearly every line of manufacturing.

But since modern civilization is based primarily on coal and iron, it is these two great industries, combined with excellent transportation facilities and fertile soil, which are the foundation stones of Pennsylvania's prosperity.

The Biggest of Uncle Sam's Coal Bins

Fully half of the coal mined in the United States comes from the Keystone State. The entire Appalachian bituminous coal fields embrace about 70,000 square miles, and about one-quarter of this area lies in Pennsylvania, mainly in the western part of the state. Its anthracite fields—lying chiefly about Scranton and Wilkes-Barre in the Wyoming valley region—add about 500 square miles to that Pennsylvania total. Here the finest coal in the world —"black diamonds" in unbelievable quantity—is produced under such conditions as to give steam in unrivaled cheapness to this region's varied industries. It is estimated that the value of the anthracite coal produced in Lucerne County alone (of which Wilkes-Barre is the county seat) is greater than the entire gold production of the United States, Alaska included.

Iron in the form of magnetite and brown hematite ores was formerly mined in considerable quantities, principally in the central and eastern parts. Indeed, it was the early development of these iron deposits, and the opening up of its coal mines, which first made Pennsylvania an industrial commonwealth. By the time its limited supplies of iron ore were exhausted, the industries based thereon had become so well established that even the discovery of enormous deposits of high grade iron ore in Michigan and Minnesota could not break the Keystone State's position of leadership in those fields. Today great fleets of giant steam barges bring this ore by way of the Great Lakes to the city of Erie, and take back cargoes of coal for the Northwest. From Erie the iron ore travels by rail to Pittsburgh and other districts of iron and steel manufacture. Coal and limestone are as essential to the production of iron and steel as is iron ore itself, and of these Pennsylvania has great abundance. So the flaming fires of coke ovens and of iron and steel mills still burn deep their impressions on the traveler's mind as his train speeds by night across this mighty state.

Rivers of Petroleum

Second only to iron and coal in economic importance, and equal to these industries in romantic interest, are the petroleum and natural gas wells of northwestern Pennsylvania. Since the first oil well was struck, in 1859, nearly one and a half billion barrels of petroleum have been produced in Pennsylvania and the production is still among the largest of any of the states. In an age when warships burn crude petroleum, when gasoline-propelled automobiles and motor trucks are almost universal, when submarines similarly driven make terrible the seas in time of war, and airplanes and dirigibles speed over the land and cross the seas—the importance of petroleum as a source of motive power will be fully appreciated.

Pennsylvania, however, is not merely a manufacturing, mining, and oil-producing state. It is a great agricultural commonwealth as well; for the skilfully managed farms of the Quakers, Pennsylvania Germans, and others in the eastern part of the state, the limestone soils of most of the mountain valleys, the beautiful grain-producing and wool-growing counties of the southeast, and the admirable pasture-lands of the northwest, more than compensate for the acreage of waste lands in the mountain districts. Wheat, Indian corn, oats, tobacco, fruit, potatoes, and hay, together with wool, live stock, and dairy products are among the staple products. In addition, large quantities of white pine, spruce, and hemlock, as well as other timber, are supplied by the extensive forests which clothe its rock-ribbed mountains. Millions of seedling trees have been planted by the State Forestry Bureau to insure that the toll taken by the woodsman's ax shall not too seriously injure the economic resources of the state.

PENNSYLVANIA'S GREAT OUTLET TO THE SEA

This great array of docks, piers, warehouses, and switchtracks is Port Richmond, part of Philadelphia's extensive waterfront on the Delaware River. Over these docks and tracks pour an unending stream of products from the inland industrial regions, as well as a large tonnage of imports. Elaborate machinery transfers the merchandise from ship to car and from car to ship. The coaling slips in the lower right-hand corner provide fuel for the steamers. A large part of Philadelphia's shipping interests consists of coastwise trade and commerce with the West Indies, and points in the Gulf of Mexico. This huge terminal extends 5,300 feet along the river, and covers an area of 224 acres. It contains 60 miles of railway track, and can store 5,900 cars.

The Great Currents of Traffic

Commerce flourishes also. The shipping of the world comes up Delaware Bay and River to the wharves of Philadelphia, the state's principal city. And from her western border leads the great Ohio, to float the products of Pennsylvania farms, factories and mines through the very heart of the land to New Orleans and the Gulf of Mexico. At Erie, on the north, the state comes in touch with the Great Lakes, whose "unsalted seas" carry "the busiest water-borne commerce in the world." The Delaware River which forms the eastern boundary of the state is navigable for steamboats at high tide as far as Trenton. The Susquehanna, however, on which is located the capital Harrisburg, and which flows out into Chesapeake Bay, is unnavigable because of its many rapids and bowlders. Canals are projected to bring iron ore from Lake Erie to Pittsburgh, and to connect the Delaware River with New York Bay. Finally, the railroad system is one of the oldest and finest in the United States, and a system of good roads covering all parts of the state is well on the way to completion.

More thriving cities are to be found in Pennsylvania than in any other state of the Union. Philadelphia, with a population of more than a million and three-quarters, is the third largest city in the country, and Pittsburgh, the industrial metropolis of the western part of the state, ranks ninth in the national list. Other cities of importance are Scranton and Wilkes-Barre, in the anthracite region in the northeast; Allentown, Reading, Lancaster, and York in the southeast; Johnstown and Altoona in the central portion; and Oil City in the Northwest. Aside from these are many busy cities of 25,000 or over, which collectively go far to make Pennsylvania so populous and prosperous a state.

The history of the state is no less interesting than its industrial activities. Founded by William Penn as a colony for the persecuted sect of Quakers, under a crown charter granted to him by the king of England in 1681, Pennsylvania became an asylum for the persecuted of all lands. Along with broad-brimmed Quaker hats and the Quaker bonnets, we may still see the quaint garb of "Pennsylvania German" Mennonites, Dunkards, Moravians, and other obscure religious bodies. The growth of the colony was rapid from the start. Delaware (the "Seven Counties") formed part of Penn's colony, and was not completely separated until the Revolution. For a time Connecticut asserted a claim to the northeastern part—the Wyoming valley; and the northwestern extension to Lake Erie, ceded to it by New York, was not obtained until 1788. During the Revolution Philadelphia was for a time the seat of the Continental Congress, and it was here that the Declaration of Independence was signed and the Liberty Bell rang out its momentous tidings; from 1790 to 1800 it was also the seat of the new Federal government of the United States. In 1794 Pennsylvania was the scene of a revolt against the payment of excise taxes known as the Whiskey Rebellion; and in the Civil War the most important battle fought in the North took place at Gettysburg. Too much credit cannot be given to this great and populous commonwealth for the part which it played in preserving the Union in the dark days of the Civil War, nor for helping to "make the world safe for democracy" in the World War of 1914–18.

Pensions. As the word is used now, a pension is usually a sum of money paid by the nation, state, or city, or by a private firm or corporation, to those who have served it faithfully and have become disabled or too old to continue their work. Pensions are also paid in certain cases to the dependents of persons who have died in the discharge of their duties. In the commonest use, the term pension applies chiefly to payments received by veterans of the army or navy, or by their dependents. We also find pensions for teachers, firemen, policemen, and other employees of the government; as well as "mothers' pensions" and "old-age pensions."

In the World War, the old military pension system of the United States was replaced by a liberal system of allowances and insurance (*see* Insurance). Before the World War, pensions for disability had been granted from time to time to the survivors of the first four American wars. Whether disabled or not, all living veterans of these wars were pensioned on the following dates: Revolutionary War, in 1818; War of 1812, in 1871; Mexican War, in 1887, and Civil War, in 1904. The government also continued to pay pensions at a higher rate to the widows and other dependents of soldiers who had been disabled during these wars. The most astonishing case on record is probably that of Esther S. Damon, the last widow entitled to a Revolutionary War pension, who died in Plymouth Union, Vt., in 1906—123 years after the close of the war.

Civil War pensions established the world's record, however, for nearly five billion dollars have been paid out to veterans of this war or their widows. As a result of the Spanish-American War, about 30,000 persons receive pensions. The rate of pensions in all these wars was fixed at from $8 to $30 a month, according to rank. A special Bureau of Pensions with thousands of clerks is maintained in Washington to take care of the many matters growing out of the pension system.

No nation has dealt so liberally with its defenders as the United States, but it is behind European nations in granting pensions to its civil employees. In most countries abroad, men and women who have served faithfully for many years in government offices may retire in their old age with enough to live on. Frequently scholars who have made important discoveries or who have distinguished themselves in literary pursuits receive government pensions in recognition of these services. Many of the great American corporations also have established pension systems for their aged employees. The average term of service required to qualify is 20 years and the retiring age is usually between 60 and 70. Some of these pension funds are created or partially supported by small annual contributions from the employees themselves.

The policy of compensating poor widowed or abandoned mothers, so they may give their children proper food and education, has gained favor in many countries of late years and more than half of the states of the United States have passed laws providing for such pensions. The amounts awarded run from $9 to $15 a month.

Great Britain has an old age pension system, which became effective in 1909, providing small weekly payments up to five shillings ($1.25) a week to citizens over 70 years of age who have lived there for the 20 years preceding. A number of other European countries have similar laws, and the movement seems to be spreading.

Peony. The peony, with its shining foliage and showy masses of brilliant bloom, is one of the commonest and most effective of our garden flowers, and has been cultivated at least since the days of the Roman author Pliny.

FROM SNOWY SIBERIA

The common White Peony originally came from Siberia, where the Mongolians still use its roots for food.

More than a thousand beautiful varieties exist. Nearly all of these are derived from the old-fashioned garden peony, which produces large solitary blossoms, usually red or crimson, but varying to white, early in the summer; or from the white peony, a native of

Siberia, which bears beautiful white and pink fragrant flowers. The flowers are usually double, but some varieties are single; in size they are often as big as a baby's head. The flowers of the Chinese peonies, a large group of hardy hybrids, are fragrant and double and vary from pure white to crimson and mahogany. All these peonies are herbaceous with tuberous roots.

Less common are the shrubby tree peonies, although they are so beautiful that they deserve to be better known. One species, native to California and Japan, grows from 5 to 6 feet tall, and bears large single or double slightly fragrant flowers, often 8 to 10 inches across. Another tree peony, recently introduced from China where there are hundreds of varieties, has striking yellow flowers, blooming in the late spring. The tree peonies are tender and require protection from winter cold in many localities. The herbaceous peonies are usually propagated by division of the shoots in the autumn or spring. New varieties are grown from seed, but this is a slow tedious process.

Scientific name of common peony, *Paeonia officinalis;* of the white Siberian peony, *Paeonia albiflora;* of the tree peonies grown in America, *Paeonia moutan* and *Paeonia lutea.*

PEPPER. No article of everyday use has a more romantic history than pepper, which is the most important of all spices and takes its place next to salt as a seasoning for food. It was one of the earliest spices known to mankind, but there were times when it was so expensive that one pound was considered a royal present, and it was used only on royal tables or by the very rich.

Taxes and tributes were often paid with pepper. Alaric, king of the Goths, at the siege of Rome in 408 A.D. demanded a ransom of gold, silver, and 3,000 pounds of pepper; and after the capture of Caesarea by the Genoese in 1101, each soldier in the conquering army received two pounds of pepper as part of his share of the spoils. Its great cost in the Middle Ages was one of the reasons which induced the Portuguese to seek a sea route to India, and after the discovery of the passage around the Cape of Good Hope the price fell considerably.

Pepper plants may be raised either from seed or from cuttings. The latter are said to yield a superior grade and larger quantity of pepper, but are fruitful only for about half as long as a plant raised from seed. The plant begins to bear in its fourth or fifth year, and will continue to bear heavily for 14 or 15 years.

The fruit of the pepper plant (*Piper nigrum*) plucked before it is fully ripe, dried and ground, yields common black pepper. White pepper is produced by removing the coatings of the ripe black pepper berry before grinding. A native of the East Indies, it is now grown in many tropical countries, especially Sumatra, Borneo, southern India, French Indo-China, Siam, the West Indies, and the Philippines. Singapore is the chief shipping port.

PICKING PEPPERS NEAR SINGAPORE

The Pepper Plant is a perennial climbing shrub or vine, which grows wild on the ground or on tree-trunks like ivy. In cultivation it is raised on wooden racks or tripods like the one you see in this picture. The great bulk of each season's crop in the Orient is collected at Singapore and shipped thence to England.

Other kinds of pepper are obtained from various plants of entirely different families. The most important are the red peppers or "chillies" of the tropical and temperate zones, which belong to the genus *Capsicum.* The fruit is used green and ripe and in tropical America is considered a necessity of existence. There are many kinds, varying in size and form of fruit. Some of the small varieties are hot as fire, such as the cayenne peppers (named after the city of Cayenne, French Guiana) and the tiny slim tabasco peppers from which tabasco sauce is made; while the large "bell" peppers of the northern markets, which are merely unripe green peppers, are mild enough to make a most agreeable addition to salads. Stuffed with cabbage pickle they make "mangoes," a favorite relish in the United States. When these bell peppers are ripe they are red and hotter, but are still milder than the small varieties. Canned in oil, they are known as "pimientos," from the Spanish word for the pepper plant. Stuffed olives usually contain ripe bell peppers which have been steeped in olive oil. Paprika is a red pepper made of the dried pods of these mild sweet peppers and can be used far more freely than the pungent cayenne pepper. The so-called Jamaica pepper is not a true pepper but belongs to the myrtle family, and is better known as allspice or pimento. (*See* Spices and Condiments.)

PEPSIN. One of the most important agents in the digestion of food in the stomach is pepsin. This is a ferment or *enzyme*, believed by most scientists to be secreted by glands in the mucous lining of the stomach (*see* Enzymes). It is found in the gastric juice or stomach secretions of nearly all vertebrates.

Pepsin has the power of digesting proteins (tissue-building foods like lean meat, peas, and the white of egg), changing them into peptones which are soluble and thus capable of absorption in the alimentary canal; but it is useless in the digestion of fats or carbohydrates. Its action is greatly stimulated by the presence of the hydrochloric acid, which is also secreted by the stomach (*see* Digestion).

When the human digestive organs become disordered and the proper amount of pepsin is no longer secreted, pepsin is given as a medicine. Commercial pepsin is produced by drying the mucous membrane of the stomachs of pigs, calves, and sheep; it appears as a yellowish powder. It is an ingredient in most digestive preparations on the market. If a healthy stomach is dosed with such digestive preparations, it soon ceases to secrete its own pepsin—in accordance with the law of nature that an unused organ tends to disappear. Pepsin has never been prepared in a pure state, and its chemical composition is unknown.

PERCENTAGE AND INTEREST. Decimal fractions in the hundredths are used so much in business and in other computations that they are given the special name of "per cent," meaning "per hundred" or "by the hundred." The decimal fraction .03 is written 3% and called 3 "per cent" (the sign % being the "per cent sign"). Thus .25 is written 25% and called 25 per cent; $.04\frac{1}{2}$ is written $4\frac{1}{2}\%$ and called $4\frac{1}{2}$ per cent.

To find 3% of a number, the number is multiplied by 3/100 or .03. Thus 3% of \$600 = 3/100 × \$600, or \$18; 3% of \$7,220 = \$7,220 × .03, or \$216.60.

Notice in the problems below how easy it is to find the per cents, by first pointing off mentally two decimal places to get 1% of each number, and then finding the whole number required. In finding 3% of 200, think of 1% as 2.00 (that is, as 2); and 3 per cent as three times that amount, or 6. Find:

2% of 400; of 700; of 900; of 1,100; of 2,200.

Certain per cents are computed more easily when the fractional equivalent is used in place of the decimal. To find 25% of a number it is easier to use the fraction $\frac{1}{4}$ than the decimal .25. To find $33\frac{1}{3}\%$ of a number it is easier to use the fraction $\frac{1}{3}$ than the decimal $.33\frac{1}{3}$. Thus, 25% of 1,200 = $\frac{1}{4}$ of 1,200, or 300. The most important of these equivalents are:

$20\% = \frac{1}{5}$
$40\% = \frac{2}{5}$
$60\% = \frac{3}{5}$
$80\% = \frac{4}{5}$
$25\% = \frac{1}{4}$
$50\% = \frac{1}{2}$
$75\% = \frac{3}{4}$
$33\frac{1}{3}\% = \frac{1}{3}$
$66\frac{2}{3}\% = \frac{2}{3}$
$16\frac{2}{3}\% = \frac{1}{6}$
$12\frac{1}{2}\% = \frac{1}{8}$
$37\frac{1}{2}\% = \frac{3}{8}$
$62\frac{1}{2}\% = \frac{5}{8}$
$87\frac{1}{2}\% = \frac{7}{8}$
$14\frac{2}{7}\% = \frac{1}{7}$

Use the fractional equivalent and find:

1. 25 % of 48; of 800; of 1,600; of 20,000.
2. $33\frac{1}{3}\%$ of 30; of 600; of 1,500; of 33,000.
3. $37\frac{1}{2}\%$ of 40; of 800; of 1,600; of 32,000.

It seems more difficult, perhaps, to find what per cent one number is of another. But it is really a very simple case of division and finding the right place to put our old friend the decimal point (*see* Decimals). "What per cent is 60 of 80?" really means dividing 60 by 80, or reducing 60/80 to a decimal, thus:

$$\begin{array}{r|r} & .75 \\ \hline 80 & 60.00 \\ & 56\ 0 \\ \hline & 4\ 00 \\ & 4\ 00 \\ \hline \end{array}$$

In other words, 60 is .75 of or 75% of 80.

See if you can solve the following problem:

If your baseball team plays 24 games and wins 18 of them, what is the percentage of victories? Should it rank higher or lower than a team that plays 33 games and wins 21 of them?

The only difficulty is that people get confused as to "which number is to be divided into which." Just watch for the little word *of*. What per cent is 17 *of* 34? 24 is what per cent *of* 72? The *of* is always *in front of the number you are going to use as a divisor.*

What Interest Is

A common use for per cent is in computing interest on money borrowed from a bank, or on that invested in some form. A farmer borrows from a bank \$500 with which to harvest his crops. The bank charges him at the rate of \$25 a year for the use of the money. This charge of \$25, or 5% of \$500, is called "interest." Interest is money paid for the use of money.

The money upon which interest is paid is called the "principal"; the per cent charged is called the "rate" of interest; the time for which interest is paid is called the "term"; the principal with the interest is called the "amount." In the illustration above, \$500 is the principal and 5% the rate. If the farmer returned the money in three months' time, three months would be called the term, and $\frac{1}{4}$ of \$25 or \$6.25 the interest, and \$506.25 the amount.

To find the interest on a given principal for a given term, the principal is multiplied by the rate, and this product by the time expressed in years or a fraction of a year. We may express it thus:

Principal × Rate × Term = Interest

To find the interest on \$1,200 at 6% for six months, the following form, since it admits of cancellation, is a convenient one:

$$\$1200 \times 6/100 \times \tfrac{1}{2} = \$36$$

In computing the time in days, it is the usual custom to regard 360 days as a year. The interest on \$3,000 at 5% for 18 days may be found by solving the following problem:

$$\$3000 \times 5/100 \times 18/360 = ?$$

At the beginning of the next page is a table, listing various bonds and rates of interest. It will help to fix in your mind practical percentage work if you will complete that table.

Kind of Bond	Interest for 5 Years	Interest for 10 Years	Interest for 20 Years	Interest for 25 Years
$50 at 4%	$10	$20	$40	?
$100 at 4%	?	?	?	?
$500 at 4½%	?	?	?	?
$1,000 at 4½%	?	?	?	?

It is more puzzling when stocks, bonds, and other securities drawing a fixed per cent or rate are advertised to yield a *higher* rate. Suppose it is a Liberty Bond due in 25 years, worth on its face or at par $100. It draws 4% and may be bought from a bond dealer at the moment for $85, and is advertised to yield 5.4%. What magic is this? None at all. The buyer gets 4% interest on $100, or $4.00, although he has invested only $85. At the end of 25 years he will also get the full $100 or $15 more than he invested. In other words he is getting in addition to his $4.00 interest a yearly return of 1/25 of $15, or 60 cents. His $85 is then bringing him $4.60 yearly, or yielding a rate or per cent found by dividing $4.60 by 85, namely, 5.41+%.

By the same simple process of division it is plain that a bond whose par value is $100 and draws 6% interest, if bought at $120, would really yield in any year only 5%—or even a lower rate, if you held it until maturity and had to distribute the difference between $120 and $100 over the interest-bearing years.

To encourage thrift among people, most savings banks pay interest on any amount from $1 to $1,000. This interest is usually paid every three months; in some banks, every month. A boy or girl depositing $10 in a savings bank, which pays 4% annual interest, would have in the bank, at the end of three months, $10+1% of $10, or $10.10. A person depositing $100 in the same bank would have $100+1% of $100, or $101 at the end of the first three months; $102.01 at the end of the second three months; $103.03 at the end of the third three months; and $104.06 at the end of the year.

$100	
1	
$101	First three months
1.01	
$102.01	Second three months
1.02	
$103.03	Third three months
1.03	
$104.06	Fourth three months

When interest is left to draw interest in this way, the interest is called "compound interest." Most savings banks pay compound interest.

Compound interest may be computed in the way just shown, or it may be worked out from tables like the one below.

In using the table to find, for example, the amount due on $500 at the end of eight interest periods, paying 1% for each period, $1.082857 is multiplied by 500. If the interest rate is 3% paid semi-annually for two years, the number of periods is four, the rate for each period is 1½%. In this case the interest on $500 is $1.061364 multiplied by 500.

COMPOUND INTEREST TABLE

Showing the Amount of One Dollar at the Given Rates for Any Number of Periods up to Ten

No. of Periods, or Times Interest is Computed	1 Per Cent	1½ Per Cent	2 Per Cent	2½ Per Cent	3 Per Cent	3½ Per Cent	4 Per Cent
1	1.010000	1.015000	1.020000	1.025000	1.030000	1.035000	1.040000
2	1.020100	1.030225	1.040400	1.050625	1.060900	1.071225	1.081600
3	1.030301	1.045678	1.061208	1.076891	1.092727	1.108718	1.124864
4	1.040604	1.061364	1.082432	1.103813	1.125509	1.147523	1.169859
5	1.051010	1.077284	1.104081	1.131408	1.159274	1.187686	1.216653
6	1.061520	1.093443	1.126162	1.159693	1.194052	1.229255	1.265319
7	1.072135	1.109845	1.148686	1.188686	1.229874	1.272279	1.315932
8	1.082857	1.126493	1.171659	1.218403	1.266770	1.316809	1.368569
9	1.093685	1.143390	1.195093	1.248863	1.304773	1.362897	1.423312
10	1.104622	1.160541	1.218994	1.280085	1.343916	1.410599	1.480244

With the help of the table above find the amount:

1. For $1,000 for eight periods, drawing interest at 1½% each.
2. For $100 for three years, drawing semi-annual interest of 2%.
3. For $300 for two years, drawing quarterly interest at 1%.

Interest as Discount

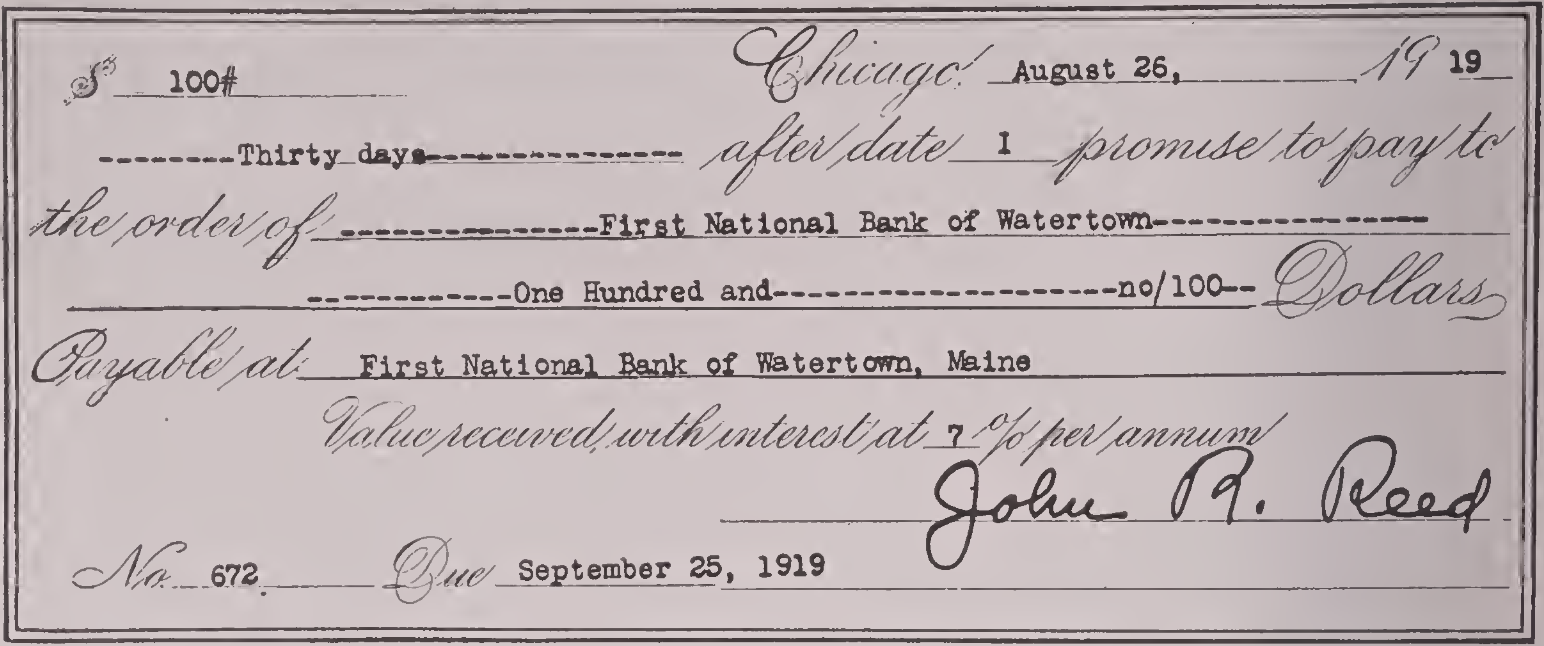
In borrowing money from a bank, it is customary for a person to write a promise to return the money, either at a stated time or when the bank demands it. Such a statement is called a "promissory note."

A manufacturer may wish to borrow $2,000 from a bank. He writes a note promising to pay the money to the bank at the end of six months. The banker charges him interest in advance. He may charge him 6% of $2,000 for six months' time, or $60 interest. This interest the banker deducts from the $2,000, paying the manufacturer $1,940. The $60 interest paid in advance is called "bank discount."

Find the bank discount on each of these notes:

1. A note for $1,000 discounted at 6% for a term of three months.
2. A note for $200 discounted at 7% for a term of six months.
3. A note for $500 discounted at 6% for a term of four months.

HOW PROMISSORY NOTES ARE MADE OUT



$ 100#   Chicago August 26, 1919

--------Thirty days---------------- after date I promise to pay to

the order of ---------------First National Bank of Watertown---------------

------------One Hundred and--------------------no/100-- Dollars

Payable at First National Bank of Watertown, Maine

Value received with interest at 7 % per annum

John R. Reed

No. 672 Due September 25, 1919

This "30-day" note shows one of the standard forms used in commercial transactions. Besides the name of the bank and the "maker," all such notes must indicate the amount, the date of maturity, and the rate of interest. You can figure in your head the amount "John R. Reed" had to pay on this note. If the rate were 6% instead of 7%, then the amount of interest for one month would be 1/12 of 6 or ½ of 1%. On $100, this would be $.50. But the rate is 7%, or ⅙ more than 6%. Therefore you add ⅙ of $.50, which is $.08⅓. As the fraction of a cent is less than ½, Reed had to pay only $.58 interest, making the total $100.58.

4. A note for $2,000 discounted at 6% for a term of 90 days.
5. A note for $800 discounted at 6% for a term of 60 days.

Promissory notes are often given at the time a purchase is made or some other debt is incurred. A farmer may buy cattle from a dealer and give him a note promising to pay a certain amount for the cattle at a given time. The cattle dealer may wish the money before payment on the note is due. If this is so, he takes the farmer's note to the bank and, if the reputation of the farmer is a good one, the banker discounts the note for the dealer. When the note falls due, the banker then collects the money from the farmer.

The time that a note falls due is called the "date of maturity." In finding the date of maturity of a note, it is the usual custom, when the time is stated in months, to count by months, and, when stated in days, to count the exact number of days. A three-months' note dated September 1 is due December 1. A 90-day note dated September 1 is due November 30 (29+31+30).

Find the maturity dates of the following notes:

1. A three-months' note dated July 2.
2. A six-months' note dated January 1.
3. A 30-day note dated August 10.

In computing the discount on a note, a banker counts from the day he discounts the note to the date of maturity. If the farmer gave the cattle dealer a three-months' note dated March 15, due June 15, and the cattle dealer had the note discounted March 25, the banker would count the days from March 25 to June 15, and charge him interest for 81 days (6 days+30 days+31 days+15 days). At the rate of 6% on $500 the banker would charge him $6; for—

$$\$500 \times 6/100 \times 81/360 = \$6.$$

Deducting the discount of $6 from $500, the "net proceeds" to the cattle dealer would be $494.

PERCH. Of the many species of these spiny-rayed fresh-water fish, the gamey yellow perch, a favorite of anglers, is the most plentiful and the most important commercially. It abounds in the fresh waters of eastern North America, in the Great Lakes, and the streams of the upper Mississippi valley, and has been introduced by the United States Fish Commission in western lakes and streams. Its back is olive green, the sides golden yellow, with six or eight dark bands, and the lower fins orange red. It reaches a length of one foot and a weight of two pounds. The eggs, about one-twelfth of an inch in diameter, are deposited in strings or bands which sometimes reach a length of seven feet.

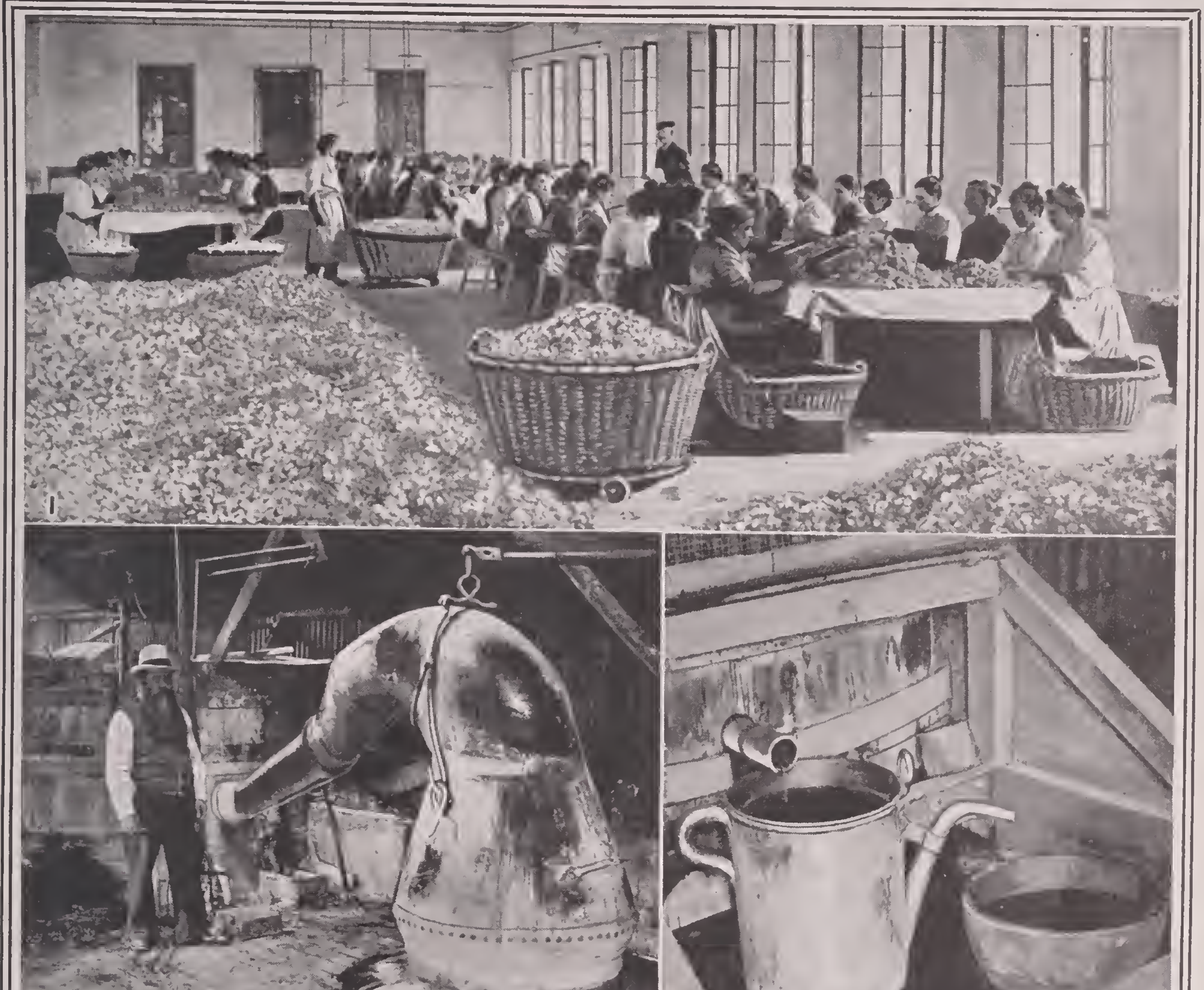
Yellow perch are sought in deep holes under shaded banks, and about bridge piers, sunken timbers, and mill-dams. They travel in schools and each school is composed of fish all of one size. In cold weather they become inactive, concealing themselves in holes. They are carnivorous and feed largely on smaller fishes, including the fry of some more valuable than themselves. The yellow perch of Europe and Asia is closely related to the American species.

A number of spiny-rayed fishes of different families are often called perch, but the name is generally and properly applied to the genus *Perca*, of which there are about 90 species, most of them American. Scientific name of American yellow perch, *Perca flavescens*.

PERFUMES. Every corner of the globe is ransacked to supply the rare and delicate odors used for milady's toilet, and millions of dollars' worth of perfumes and perfume-yielding substances are yearly brought to the United States from Europe, Asia, Africa, and South America.

By far the greater part of the American supply is imported, for only a beginning has been made in the

CATCHING THE "SPIRIT" OF THE FLOWER



These photographs were taken during the preparation of oil of lavender, but the process is the same for making all other natural vegetable perfumes. The finest lavender is prepared from the flowers alone, but frequently the stems are also put through the process. 1. Women sorting petals and removing any foreign matter which may have been gathered with the flowers. 2. The petals are boiled in a great retort, from which the vapor is drawn off and condensed in the tank at the left. 3. The distilled liquid emerges from the still. 4. Removing lavender stalks from the still after distillation. This is done by thrusting long rakes down into the boiler, which lies beneath the floor.

industry of growing plants and flowers for perfumes in the United States. The sweet scents that perfume our soaps and candies, or that we put on our handkerchiefs, come from far-away Zanzibar, Uganda, Java, Cyprus, China, Tibet, Burma, Peru, San Salvador, and a hundred other distant and romantic places. Millions of pounds of lovely roses, orange blossoms, violets, tuberoses, and other flowers are gathered and taken to great perfume factories to yield up their fragrance. Odorous woods, seeds, roots, resins, and spices are collected, and certain animals that secrete substances of pleasing aroma are ruthlessly slain for their perfume sacs.

A "PERFUME" FARM IN SUNNY FRANCE

This is a farm in the Riviera district of southern France, where flowers are grown for making perfumery. Even in such a warm climate, the flower farmer takes no chances. Each night he covers the beds with screens, which you now see rolled up to let the sun shine on the flowers. Special care is needed to develop the highest fragrance in the blossoms.

The world contains few more interesting sights than the perfume-making district of southern France, around Grasse, Cannes, and Nice. Beautiful fields of flowers stretch away on every side, filling the air for miles with their delicate scents. In the fields you see men, women, and children gathering the precious blossoms and heaping them up in great baskets, and along the roads pass streams of wagons, each filled to the top with loads of flowers for the factories. There, each little blossom gives up its tiny drops of fragrant oil, to be bottled and sent, perhaps, to some distant part of the world. It is said that the total weight of the flowers gathered in this district is between 10 and 12 billion pounds a year.

There are two principal classes of perfumes, the animal and the vegetable. Of the four animal perfumes, musk is the most important. It is a reddish-brown substance of the consistency of honey, obtained from the musk deer, an inhabitant of the plateaus of Central Asia (*see* Musk Deer). It is a powerful and enduring perfume and gives odor to everything in contact with it, or near it. Even polished steel if shut in a box with musk will become fragrant of it. Musk is used in minute quantities to give permanence to other odors that by themselves soon disappear. Its price is now very high, because of the growing scarcity of the animal that produces it.

Ambergris is a secretion of the intestines of the sperm whale. It is a waxy substance of different colors—white, black, yellow, ash-gray, or variegated—and it is frequently found floating in large masses (sometimes 200 pounds) in the Indian Ocean and other tropical seas. Civet comes from glands of the civet cat, a native of Asia and northern Africa. It is of a clear yellowish-brown color and of the consistency of butter. When civet is pure, the odor, which is the same as that of the narcissus, is unbearable. It is useful in diluted form in soaps and sachets. Castor comes from glands of the beaver. It is dark colored and has a strong lasting penetrating odor which is very pleasant, especially when the perfume is old.

Of the vegetable or plant perfumes, the simplest are those exhaled by dried flowers, and the combination of these with spices, odorous woods, and herbs. The fragrant gum-resins belong here, of which the most important are benzoin, myrrh, storax, and the balsams of Peru and Tolu. Great quantities of these gums are used in making incense.

Most of our perfumes, however, are obtained by removing the fragrant oils from plants by various processes. Those obtained by distilling flowers, bark, seeds, or other odor-bearing substances are called "essential oils" or "ottos," from the Turkish word *attar*. The active principle of odor-bearing plants is in the sacs or glands; these may be in the rind, as in a lemon or orange; in leaves, as in sage and thyme; in bark, as in cinnamon; in seeds, as in caraway and nutmeg; in the petals, as in the rose and lavender; in wood, as in sandalwood and rosewood. The problem of the perfumer is to get the essential oil as pure as may be without injuring it. Delicacy and care are required in the operations. Sometimes the flower is crushed and soaked in alcohol, as in the case of the iris. Or the oil may be squeezed out by hand, as from citron, orange, and bergamot. Others are distilled, as roses, lavender, rosemary, sandalwood, and ylang-ylang (the flowers of a Malayan tree).

The most important of these oils is the famous attar of roses, which is chiefly obtained by steam distillation of rose petals in France. Smaller quantities come from Persia, India, Syria, and Turkey. An acre of roses yields about a ton of rose petals under favorable conditions, and a ton of the petals makes from 10 ounces to a pound of the oil of roses, so it is easy to see why the price has gone as high as $28 an ounce. The odor is so powerful that one drop is enough to give fragrance to a gallon of cologne. Attar of roses is chiefly used as an ingredient in perfumes and toilet waters, but may be obtained at retail in tiny bottles containing only a few drops.

For very delicate flowers more subtle means are necessary to capture their fragrance. These processes depend on the power of fats to absorb odors; they are known as the cold process, or *enfleurage*, and the hot process or *maceration*. In the cold process, lard, beef-suet, or some other grease is spread out thinly on glass plates and air is passed over the flowers and to the lard. The flowers are renewed until the fat contains all the perfume it can take up. In the hot process, flowers in linen bags are hung in jars of warm lard or vaseline till the perfume is taken up. The perfume is then dissolved out of the fat with various solvents, such as alcohol, and ether.

Besides these animal and vegetable perfumes, various artificial or synthetic perfumes are made, sometimes by combining chemicals, but generally by the chemical manipulation of plant oils. Some of these synthetic perfumes have a remarkable similarity to natural perfumes, but no chemist has yet succeeded in producing perfumes as delicate as those manufactured by nature.

This is partly because the theoretically simple process of synthesizing the various aromatic compounds is actually very difficult, and partly because the slightest impurity—one which it may be difficult to detect chemically—may spoil the perfume, as a false note spoils the rendering of a musical composition. Therefore, though a synthetic musk, an artificial vanillin, and many other substances used by perfumers are compounded by chemists, they are used chiefly in the cheaper grades of perfumes, and have not as yet diminished the demand for the natural perfume bases.

From the earliest times men have prized perfumes and known the art of making them. Perfume bottles are frequently discovered in excavating city sites of the ancient East, and early literatures are full of references to precious sweet-scented oils. In the Middle Ages the Arabs were conspicuous for their skill in the manufacture of perfumes. Thus the idea of sweet odors came to be generally associated with Arabia, as we see in the many references by the poets. After the murder of Duncan, Shakespeare makes Lady Macbeth say:

> All the perfumes of Arabia will not
> Sweeten this little hand.

France and Italy also learned early the art of making perfumes, and France is still the greatest growing and manufacturing center. England is unsurpassed for its lavender and peppermint. In the United States, sassafras, peppermint, spearmint, wintergreen, and cedar oils are produced in large quantities, but these are more used for flavoring than for perfumes.

PERICLES
Leader at Athens in the "Golden Age"

PERICLES (about 493–429 B.C.). When we think of Athens, the greatest city of Greece, at the height of its glory, we think of Pericles, the statesman who made possible that golden age which bears his name, and who represents to the world the ideal Athenian.

Pericles' power exceeded that of many kings and tyrants, yet he never held the office of *archon*, which was supposed to be the highest in the state. He was simply one of the ten "generals" (*strategi*) elected each year by the Athenians to manage their affairs at home and abroad, and he owed his power entirely to his personal ascendancy and his persuasive eloquence. He ruled Athens because the Athenians learned to trust him. For 30 years they reëlected him, and he made their city glorious and never failed them in times of difficulty. When he appeared before the assembly, so serene and quiet was his manner that he might have been taken "for a god from Olympus."

More than anything else Pericles was interested in the good of the common people, although he himself was of the richest and most powerful family in all Athens. To begin with, he got the poor man enough to eat and an equal chance before the law, and then laid art and beauty open to him. The temples and statues of the Acropolis which he caused to be erected were more beautiful than the richest man's private house; and in order that the poor man might also enjoy music and drama, Pericles arranged for him to have a ticket and paid him, so that he could afford to stop his work to attend the performance. Thus the people lived in an atmosphere of beauty and culture such as the wealthiest men could not have procured for themselves. His enemies charged him with spending the public money too freely, but he spent it all for the good of the people and the glory of Athens. Pericles came of the powerful family of the Alcmaeonidae, "the most brilliant, the most ambitious, and the most democratic of the noble families of Athens." The greatest events in Greek history took place in his lifetime. He was born not long before the battle of Marathon (490 B.C.), and as a boy probably witnessed the battle of Salamis in which the Greek fleet defeated the host of Persian invaders. When as a young man he entered public life, Athens still retained the scars of these terrible conflicts. Under his patronage were produced the wonderful sculptures of Phidias and the great dramas of Euripides and Sophocles.

Pericles realized his ambition to make Athens, "the queen of Hellas," not only the most beautiful but the most powerful of the Greek states. But he lived also to see the states of the Peloponnesus, under Sparta's leadership, rise against Athens' overgrown power in the Peloponnesian War. The closing years of his life were times of storm and trouble. While Athens was besieged by the enemy without the walls, a terrible plague raged within. For the first time Pericles fell out of popular favor, was deposed from office, and was even fined 50 talents on a charge of embezzlement. Only a few weeks later the people repented and reinstated him with greater powers than before. But the plague, which had made him temporarily unpopular, had left its mark on Pericles himself, and he died in the autumn of the next year.

The speeches of Pericles were not written down and preserved, as were those of Demosthenes and other Greek orators a hundred years later, but Thucydides in his history gives us some idea of Pericles' power as an orator. The funeral oration that he represents Pericles as speaking over the dead in the first year of the Peloponnesian War is especially noble: "Of all cities Athens alone is even greater than her fame. She needs no poet to sing her praises; every land and every sea can furnish proofs of her enterprise and success. Her enemies when defeated are not disgraced; her subjects confess that she is worthy to rule them." In concluding, he says of those who have died in her defense: "To men who fall as they have fallen death is no evil."

PERISCOPE. Man's third eye, enabling him to see around a corner, out of a ditch, or from under water, which even the fly with all his eyes can't do—such is the periscope, a combination of telescope and camera obscura (*see* Camera). The periscope is used on the submerged submarine to see what's going on above the surface of the sea. Usually it is a straight rigid vertical pipe four to six inches in diameter, encased within an outer protecting pipe, and protruding upward from the interior of the submarine 20 feet or more, so that its "seeing" end is several feet above the surface of the sea. At the top and bottom are reflecting mirrors or prisms with the reflecting surfaces parallel to each other and at a 45° angle with the walls of the pipe, and with several lenses between them. Near the lower end is the eyepiece, an arrangement resembling a stereoscope, through which the commander of the submerged boat sees the scene very much as he would from a conning tower. By means of horizontal and vertical marks on the mirror he can estimate how far any ship is from him, and its direction and speed; and he can rotate the periscope and thus scan the whole horizon. The periscope is lowered when the submarine dives or comes to the surface.

Above the sea the periscope looks like a tiny lighthouse or like a little pipe with an elbow joint, according to type. As the boat glides along under water the periscope leaves a foamy, V-shaped wake—a mark which betrayed the submarine's presence to the lookouts on transports and destroyers during the World War of 1914–18.

The field periscope, a smaller and less elaborate instrument, is used in land warfare in trenches and behind earthworks and parapets for observing the surrounding landscape without risking a peep over the top. (*See* Lens; Submarine.)

PERRY, OLIVER HAZARD (1785–1819). "To windward or to leeward, they shall fight today." This was the grim determination which the venturesome young commander, Oliver Hazard Perry, announced on Sept. 10, 1813, when some of his officers begged him to refrain from battle with the British that day on account of the wind's direction. And with this decision he engaged in the bloody battle of Lake Erie, upon the issue of which rests his fame as one of the great naval heroes of the United States.

Several motives inspired Perry's determination. For one thing he had the family honor to sustain. His father had served with credit as a naval officer in the Revolutionary War, his three older brothers were then serving in the navy in the War of 1812, and his youngest brother was with him on board the *Lawrence* at the time of battle. He himself had entered the navy as a midshipman from his Rhode Island home in 1799, had served in the war against the Barbary pirates, and at his own request had been sent to serve on Lake Erie in the war.

Here at Presque Isle, now Erie, Pa., in the midst of a wilderness, he had undertaken with enthusiasm the arduous task of building and equipping a fleet, although men and materials had to be brought through trackless forests from the seaboard, 500 miles away. The work had been successfully completed and Perry had under his command nine small vessels which he was anxious to use. The fact that his commanding officer, Commodore Chauncey, had not given him the support and encouragement he needed was an additional reason for showing that he could win in spite of all difficulties.

The results of Perry's decision justified his expectations. His own vessel, the *Lawrence*, was so disabled that he had to leave it and row to the *Niagara* in a hail of bullets, but within two hours after leaving his ship he sent his famous message: "We have met the enemy and they are ours—two ships, two brigs, one schooner, and one sloop." For the first time in its long naval history, a British fleet had been compelled to surrender.

For this victory Perry was rewarded with the rank of captain and a vote of thanks by Congress. He was regarded by the people of the country as the naval hero of the war, and was popularly known as "Commodore" Perry. After peace was declared he was placed in command of a squadron in the West Indies, and there met his death a few years later from the dreaded yellow fever.

In 1913 was celebrated the hundredth anniversary of Perry's victory on Lake Erie, at which time the Perry Memorial, erected at Put-in-Bay, Ohio, was dedicated.

The GREEK HERO *who* SLEW *the* MEDUSA

PER'SEUS. Once upon a time, so the old Greeks tell us, there was a king of Argos, old and none too good, whose name was Acrisius. Now this king had a beautiful daughter named Danaë, whom he feared, because an oracle had told him that she would bear a son who would kill the old king. So Acrisius built a tower of brass, without a door, and here he shut up the maiden. And she was lonely. But one day a shower of gold fell through the window of the tower, and in the gold was Zeus the king of the gods. So Danaë was lonely no longer, and after a time she bore a son, and named him Perseus.

But when Acrisius heard of the child he was very angry, and he ordered that the child and its mother be set adrift on the sea in a chest. For days they drifted, but Zeus watched over them, and the chest was at last cast safely on the shores of an island, where a good fisherman named Dictys cared for them.

Here Perseus grew to be a young man, strong and blond and beautiful. And he loved his mother dearly, for she was good as well as lovely. But one day Polydectes, the king of the country, saw Danaë, and loved her and wished to marry her. Danaë would not consent. Then Polydectes saw that if he would win the mother he must first be rid of the son. So he sent Perseus to fetch him the head of Medusa, thinking the lad would be killed.

This Medusa was one of three terrible sisters, called Gorgons, who had leathery wings, brazen claws, and, worst of all, writhing poisonous snakes instead of hair. They were so horrible to see that anyone who looked at their faces was turned to stone. So naturally Polydectes thought he should never be troubled by the presence of Perseus again.

PERSEUS DENOUNCING POLYDECTES

When Perseus returned home and learned that his mother had been forced to flee to escape the violence of King Polydectes, he would have slain the king had not his mother thrown herself upon him and begged him to stop, for she feared that the people would avenge the king's death. Thereupon Perseus turned Polydectes and all his court into stone by showing them the head of Medusa. The island itself became stone, and the very frogs (so says the legend) became dumb.

But the boy was half a god and the old gods helped him. Athena, the goddess of wisdom, lent him her shield polished as brightly as a mirror; Hermes gave him a magic sword and a pair of winged sandals; and Pluto the cap of darkness which made him invisible.

With these things Perseus set out gaily, and after a long time he came to the land of eternal night, where the Graeae, the three Gray Sisters, sat shivering and mumbling. They were so old that they hated anything young and happy, and they had only one eye and one tooth among them. At first they refused to help Perseus, but the lad stole the eye as one sister was passing it to another, and wouldn't give it back till they had told him where he could find the Gorgons.

Then he set out again, and flew and flew till the wind whistled behind him. At last he saw far off the three Gorgons asleep. He put on his cap of darkness and flew nearer, till he hovered over them. Alighting, he held up the shining shield and looked into it, for a sight of the monster Medusa herself would turn anyone into stone. With a single sweep of the magic sword he then cut off Medusa's head. He hid the head in his wallet and fled. The other two Gorgons awoke, but the winged sandals bore him safely away, and he left them behind.

Presently Perseus came to the kingdom of Atlas, the Titan, and asked shelter. But Atlas answered him rudely, and Perseus grew angry and held up before his gaze Medusa's head, and so turned Atlas into the great mountain on which the skies rest.

After a time Perseus saw that he was flying above a country that had been devastated by earthquakes and by floods, so that the people lived in wretchedness. And as he flew, wondering, by the seacoast, he saw a beautiful maiden chained to a rock beside the sea. Quickly he flew down and saw that she was weeping. And Perseus said:

"Surely you are a king's daughter. Do they treat kings' daughters so in this strange land?"

Then the maiden answered and told him that her name was Andromeda, and that her father Cepheus was indeed king of the land. Her mother the queen, whose name was Cassiopeia, was very beautiful and very proud, and one day she had boasted that the sea nymphs were not more beautiful than her daughter. Then the nymphs were angry and complained to Poseidon, the sea-god, and he sent floods and earthquakes and at last a great sea-monster to devastate the country. The monster could only be bought off by offering him the queen's daughter Andromeda as a victim. So now she was chained thus to the rock, awaiting death. It was small wonder that she wept.

But Perseus feared no monster, and when the great beast came he fell upon it with his magic sword and slew it. Then he cut the chains that bound Andromeda to the rock and bore her back to her rejoicing parents. And Cepheus gave Perseus his daughter's hand in marriage. But at the wedding feast an old suitor, who had made no effort to help her while she was in danger, claimed Andromeda, and Perseus had to turn him into stone also.

Then the hero with his bride set out for his island home, and arrived just in time to rescue his mother Danaë from King Polydectes, who was still troubling her. This king too the youth turned to stone with the convenient Gorgon's head. Then with his mother and his bride he returned to Argos, the land of his birth. Here he found that his grandfather Acrisius had gone to Larissa to watch the games there. So Perseus followed after, and took part in the games. As he was throwing a quoit in one of the contests it accidentally struck his grandfather and killed the old man. Thus the prophecy was fulfilled, which foretold that Acrisius should be slain by Danaë's son.

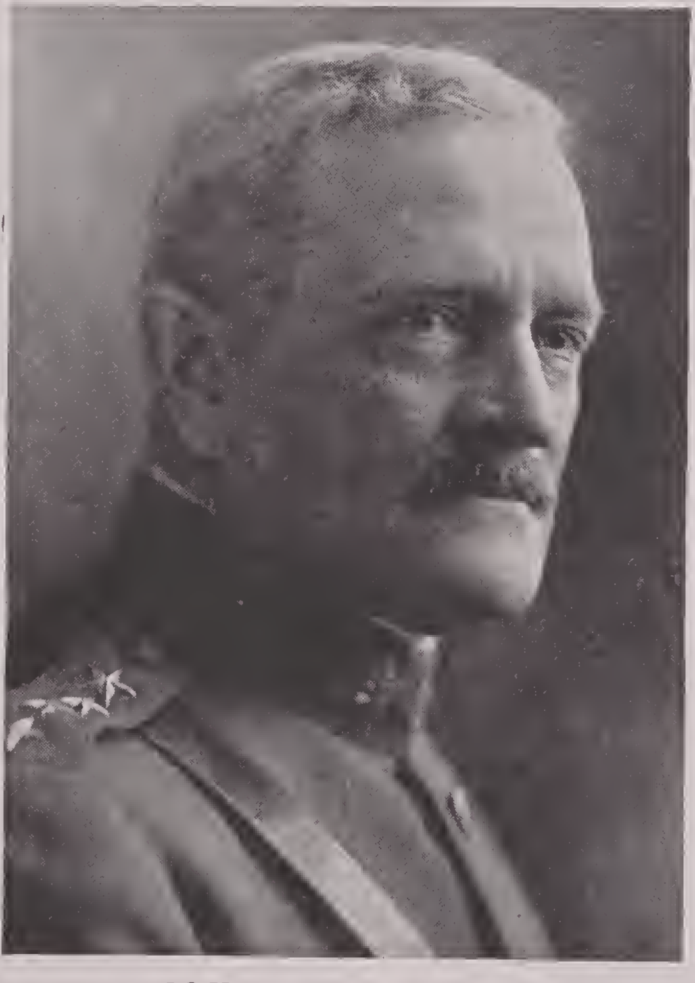
Perseus and Danaë and Andromeda lived long and happily in Perseus' kingdom, and the goddess Athena, to whom Perseus gave the Gorgon's head to fasten on her shield, befriended them always and made them wise. So that after his death Perseus was worshiped as a god, and Zeus his father took him into the sky, with Andromeda and Cassiopeia and Cepheus, where you may see them shining as bright constellations to this very day.

The name *Medusae* is given to a group of free-swimming jelly-fish, with many long tentacles, which give them a fancied resemblance to Medusa the Gorgon (*see* Jelly-Fish).

PERSHING, GEN. JOHN JOSEPH (born 1860). Son of a railway section boss, born in a little shanty near an obscure town in Missouri; 58 years later an international figure, commander of the army that turned the scale in the greatest war in history—that is, in brief, the story of Pershing. Between these two points is a picturesque and adventurous life during which, step by step, "Black Jack" advanced to the rank of full general, a title which has been held by only four other Americans. Six feet in height, broad-shouldered, straight as an arrow, clear-eyed and direct, he looks every inch the soldier and a worthy successor to Washington, Grant, Sherman, and Sheridan.

As a boy Pershing was not thought exceptionally brilliant, but he was noted for his dogged determination. And one of the things he determined to do was to get an education. When he was 17 he began to teach in a country school, and some time later, with the money he had saved, he entered the Normal School at Kirksville, Mo. While there he chanced to see an announcement in a paper that changed his entire life. It was a notice of a competitive examination for West Point Military Academy. He did not then think of a military career; but he wanted an education and West Point offered an unusual opportunity. He won the examination by a single point.

Graduating from West Point in 1886, he at once began active service against the rebel Indians in the West. Five years later he received the appointment



JOHN J. PERSHING
Commander of the greatest army the United States has ever placed in the field.

as military instructor at the University of Nebraska, where he found the opportunity he had long wanted of studying law. He completed the full course and received the degree of Bachelor of Laws. From there he was called to West Point as an instructor in tactics, where he remained until the Spanish War in 1898, when he at once asked for active service. He was among the first 15,000 who sailed for Cuba, and two days later he was fighting in the battle of San Juan Hill. Afterwards General Baldwin said of him: "I have been in many fights in the Civil War, but Captain Pershing is the coolest man under fire I ever saw in my life."

On his return Pershing requested to be sent to the Philippine Islands which the United States had just purchased. His work there was the subjugation of the islands' savage tribes, the largest of which was the Moros, a people whom the Spaniards had never succeeded in conquering. In 1903 he was recalled, made a member of the General Staff Corps in the United States, and in 1905, when the Russo-Japanese War broke out, he was appointed military observer with the Japanese army, a position which gave him an opportunity to study modern warfare on a large scale.

He was now 45 years old and still a captain. Advancement in the army was too slow, Roosevelt thought, for an officer of his ability. He suggested promotion to Congress and finally, tired of the delay, with one flourish of the pen jumped Pershing over the heads of 862 officers of higher rank and made him a brigadier-general.

In 1909 Pershing returned to the Philippines as governor of the Moro Province, where he remained until 1914, when he was recalled for work on the Mexican border. While in El Paso he experienced the greatest tragedy of his life. He received news that in a fire at the Presidio Hotel in San Francisco his wife and three daughters had been burned to death. His son Warren alone survived. But the soldier triumphed over grief, and Pershing went quietly on with his work in pursuit of the bandit Villa.

In the meantime war was raging across the ocean. Finally the United States was drawn into the struggle. Secretary of War Baker and President Wilson knew that in General Pershing they had the right man for the command, and a few weeks later he was crossing the ocean on the way to France.

It was a historic moment when General Pershing arrived at Boulogne. For the first time an American commander was to lead American troops on European soil. Never since the war began had Paris given such a welcome to a visitor as was given to the American general. Tens of thousands of men, women, and children crowded the streets, waving the American flag and shouting, "Vive l'Amerique! Vive Pershing!"

Following Pershing came ship after ship of American soldiers. Given an absolutely free hand by President Wilson, Pershing had the heavy burden of shaping and training a whole army organization which ultimately expanded in a year and half to nearly 2,000,000 men. In this organization work he was wholly successful. His final test as a commander of men in the field was short, practically only the last few months of the war, but the record of those months when finally weighed will give General Pershing a high place as a commander.

ISOLATED PERSIA—*Land of Rugged* DESERTS

Extent.—North to south, about 860 miles; east to west, 1,385 miles. Area, about 628,000 square miles. Population, between 8,000,000 and 10,000,000 (about 15 to the square mile).

Physical Features.—Western half of Iranian plateau (general altitude, 3,000 to 5,000 feet), crossed by numerous mountain ranges (Mt. Demavend, 18,600 feet); salt and sandy deserts cover about two-thirds of the plateau area. Salt lakes, Sistan and Urmia. Caspian Sea on north, Persian Gulf and Gulf of Oman on south; only navigable river, Karun.

Principal Products.—Wheat, barley, cotton, tobacco, rice, fruit, and nuts; silk, opium, gums; wool and hides; iron, copper, tin, lead, coal, petroleum, turquoise, salt, etc.; rugs and carpets; attar of roses.

Chief Cities.—Teheran (capital, more than 220,000), Tabriz (200,000), Kermanshah, Ispahan, Meshed, Kerman, Shiraz, and Yezd (all less than 100,000).

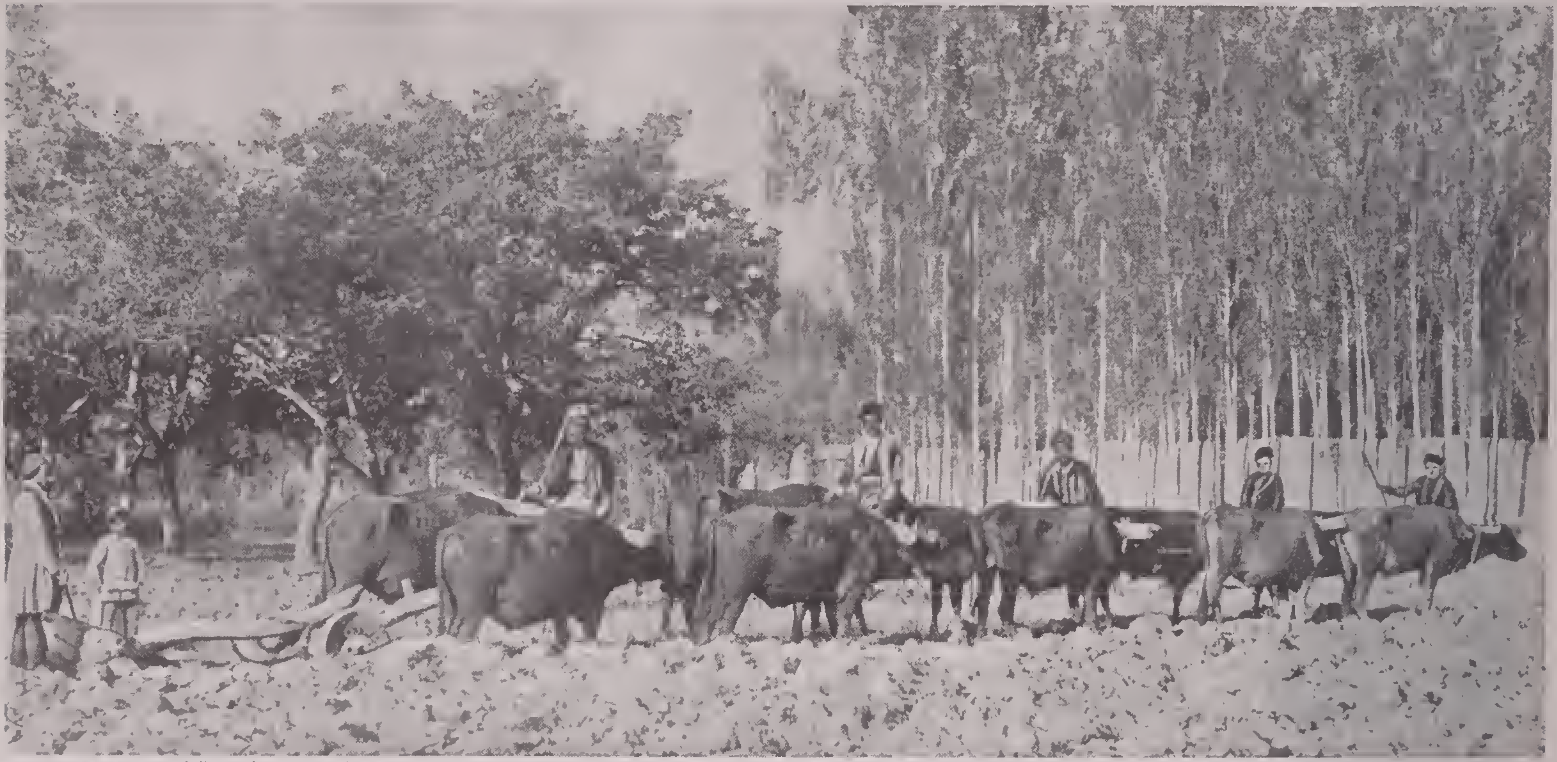
PERSIA. Imagine a country more than three times as large as France, with probably less than one-fourth as many people (no census has been taken for 60 or 70 years); with but a hundred miles of railroads at the close of the World War and fewer miles of roads passable for motor cars than there are of paved streets in Philadelphia; with only one city of more than a quarter of a million; with 900 miles of coast line and only two ships in the navy! Such is Persia today. Of the empire that 25 centuries ago extended from the Indus to the Dānube, and from the Oxus to the Nile, only the western half of the Iranian plateau remains.

Today Persia, "the land of the Lion and Sun," is for the rest of the world simply a country out of which come beautiful things—Omar Khayyam's poems and countless legends and fables; "Persian" rugs, usually in exquisite flower patterns woven of silk or of fine wool by hand, a knot at a time; attar of roses from the gardens of Shiraz; and turquoises from Nishapur. For the collector it means old porcelains having a rare apple-green glaze, and manuscripts illuminated with delicate miniatures of turbaned princes, flowering trees, and dancing gazelles, so faultless that there may be hundreds of figures in one square foot of battle scene, all of which will stand scrutiny with a magnifying glass.

Persia's Plateaus and Deserts

Persia has been sung by the poets as the land of luscious fruits, of roses and nightingales; and yet the Iranian plateau, which it shares with Afghanistan and Baluchistan to the east, is a high arid region more than two-thirds desert. It lies from 3,000 to 5,000 feet above sea level, with range after range of mountains traversing it from northwest to southeast, and rising to snowy heights of 10,000 to nearly 19,000 feet.

THEY'VE PLOWED THIS WAY FOR 2,000 YEARS



The peasants of Persia have been little influenced by Western civilization. This plow is the crotch of a hardwood tree, cut so that one end, sharpened and shod with iron, forms the plowshare, while the main trunk serves as the beam.

To enter Persia is like climbing a ladder, whether you come across the Caspian Sea from Russia, or follow the old caravan trail from Trebizond, or sail up the Tigris from the Persian Gulf, and take the older and steeper trail between Bagdad and Kermanshah. This is the way the English and Indian cottons and teas go, and sometimes it happens that a caravan falls into the hands of marauding Kurds and Lurs, who pounce upon it in the mountain fastnesses and exact a ransom for each camel.

HOW PERSIANS MAKE BUTTER

These women are using a goat skin for a churn. They shake it vigorously until the cream inside turns to butter.

In one-third of Persia nothing could ever be made to grow, no matter how you irrigated and tended the soil. The great salt deserts, or Kavirs, as the Persians call them, occupy the greater part of the eastern provinces. Across the salt deserts and the adjoining sandy deserts stretches a line of oasis towns like stepping stones—Meshed, the most hallowed spot for Mohammedans in Persia; then Tabbas; then Yezd, in the very heart of Persia, and important for its silk manufactures and opium trade; then Kerman. There is a prophecy that Yezd will some day be overwhelmed by the desert sands that now drift over its walls and that have long since overwhelmed surrounding villages. At Kerman are manufactured some of the most beautiful Persian rugs. Forty miles west of Meshed, in a fertile plain, lies Nishapur, the birthplace of the poet Omar Khayyam. The town has fallen into decay, but turquoises are still mined near by.

It is in the western part of Persia that you will find most of the great cities and all that have been capitals in ancient and modern times. Here are Susa and Ecbatana, now Hamadan, the cities one reads of in Xenophon. Susa is the ancient "Shushan," where the story of the book of Esther is laid. Here, too, is Shiraz, the city of wine, rosewater, and attar of roses; and 35 miles east lie the ruins of Persepolis, the great city that Alexander destroyed in 330 B.C. These ruins are among the most important that have survived from the great ancient days of Persia. Ispahan, once a capital, lies at the center of the habitable part of Persia, in a pleasant well-cultivated plain. Tabriz, in the northwest, is an important commercial center and the terminal of the railroad from Tiflis. Teheran, the modern capital, lies at the foot of the Elburz Mountains, only 70 miles from the Caspian Sea. The city, to which you slowly climb by horse and carriage, lies at an altitude of 4,000 feet, overlooked by the snowy peak of Demavend, the highest mountain in Persia. The air is dry and bracing, and you can see for almost unbelievable distances. At night the stars are so near and clear that you do not wonder the early Persians were star-gazers and astrologers, and that "magi," their word for priests, grew into our word "magic."

DRESSED FOR THE STREET

Her own husband could not recognize this Persian woman if he met her on the street. Persian women all wear this same veiled costume when appearing in public. A bit of gauze before the eyes lets them see out.

Teheran has a beautiful gate of colored porcelain tiles, and all the better houses are provided with little parks and ponds, and luxurious high-vaulted underground rooms for the unbearable heat of summer; but the total effect of the city is a dismal one on account of the filthy narrow streets and gray mud buildings. During the past 50 years the rulers or shahs have made various attempts to modernize their capital city. A street-car line was built, and they attempted a gas works, but found it very expensive since all coal must be brought 30 miles by pack animals. The typical Persian commodities, rugs, dried fruits, jewels, and grain, do not suffer much in being carried hundreds of miles in springless wagons, or by mules and camels, along the roads and trails that connect the bazaars of Teheran with the rest of the world; but anything typically European, such as a piano, suffers considerably. The water supply is brought by canals from the mountains; it is sufficient in winter, but usually runs short in summer when you most need it.

Persian Shepherds and Farmers

About one-fourth of the people of Persia are city dwellers, and another fourth are nomads—Arabs, Turks, Kurds and Leks, Baluchis and gipsies, and Lurs.

HE LIKES A COOL SMOKE

The Persian, like the Turk, usually smokes a "hooka," or "narghile," in which the smoke from the tobacco bowl first passes through perfumed water in that jar and then through that long tube to the smoker.

These nomads pasture their flocks and herds in the grassy valleys and on the slopes of the mountain ranges of the interior of Persia, and prey upon the peaceful communities for agricultural supplies. Throughout Khorasan you will see a queer sort of tower that the farmers build as a refuge from these marauders. It is a round mud wall about 14 feet high, inclosing an empty space and having its entrance so low that you can only get in on all fours.

A MODEST HOUSE DRESS

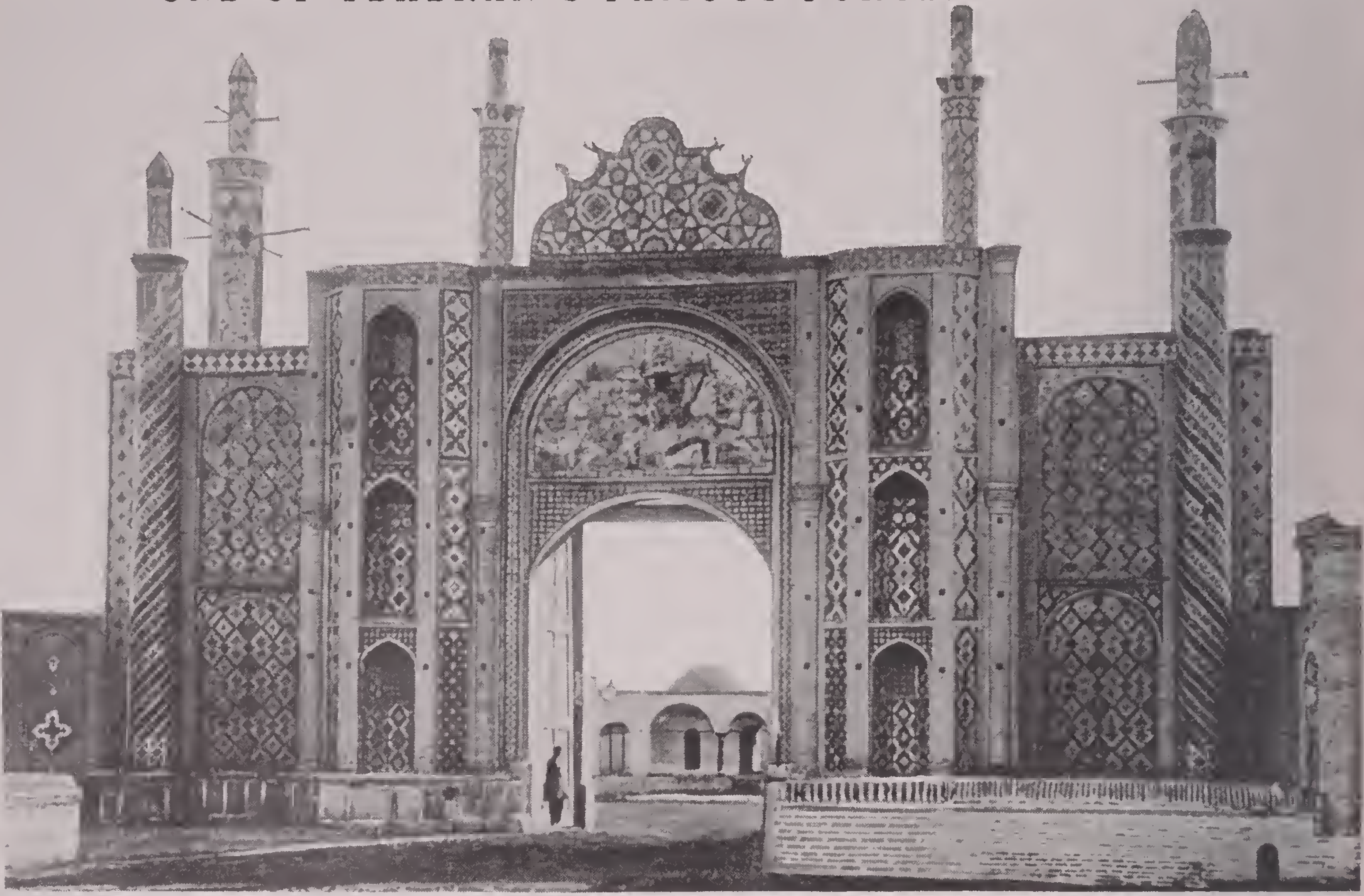
The outer garment is a short jacket of bright colors, entirely open at the front, with tight sleeves. Under the outer skirt, which is usually of silk or velvet, are innumerable other skirts of the same ample width.

Half the people are peasants, tillers of the soil, and this in spite of the fact that only three or four districts of Persia are naturally fertile. The most important agricultural province is Azerbaijan to the extreme northwest. This is the closed basin of Lake Urmia, a broad shallow sheet of intensely salt water, in the bed of an ocean once ten times as large. The region is known to many Americans because of the American mission at the city of Urmia which met such sufferings at the hands of the Kurds and Turks in the World War. There are also many isolated oases such as Shiraz and Ispahan.

In most places the Persian peasant can wrest crops from the soil only by irrigation, and irrigation is not the simple matter of canals and surface channels that it is in Mesopotamia or in the west of Armenia. Having little rain and few rivers, he must use the mountain snows as they melt, and must bring the water, often long distances, by tunnel—otherwise it would evaporate in the dry air and bright sun before reaching him. But for the mountains that store moisture in the form of snow, nine-tenths of Persia would be the desert that more than one-half is now. Sometimes, too, the peasant digs deep wells to water his land.

Beneath this barren land lies buried the key to Persia's future—

ONE OF TEHERAN'S FAMOUS PORCELAIN GATES



This is one of the twelve city gates from which the main streets lead to the great central bazaar or market-place of Teheran, where the products of native and foreign industry are mingled in hopeless confusion. Amid a babel of Persian, Turkish, Arabic, Hindu, Hebrew, and Armenian, the traveler can buy anything from an American-made hairpin to an antique rug.

oil. Vast petroleum fields stretch from the Caspian Sea to the Persian Gulf. The natives have long gathered the heavy oil floating on the surface of streams for calking their boats, but they have not used it to increase their all too scanty fuel supply. The fields are now being worked by foreign capital. Copper, iron, tin, lead, rock salt, and coal occur in large quantities, especially in the mountains of central and western Persia. Although some of these minerals have been mined for centuries, the methods have been primitive and it remains for modern engineering to develop these great resources.

Always Haunted by Hunger

The peasants have been little affected by western civilization. After 2,000 years and more of successive conquests, they continue to till their soil just as Zoroaster and the Zend Avesta told them to do several centuries before Alexander. They use the ancient plow, a crotch of a hardwood tree cut so that one branch may be sharpened and shod with iron for the plowshare, while the main trunk serves as the beam. They use the same flail, the same lumbering cart, the same yoke and ox-goad, the same hand-mill topped by a round hopper into which the grain to be ground is poured, and a glistening sickle so curved that it almost seems like a hook.

The crops are always small. In good seasons a man raises little more than enough for himself, and a crop failure means starvation in that district. Hunger always lurks around the corner in Persia, and poverty is ever present.

Most of the people are Mohammedans of the Shiite sect, and are inclined to look upon the innovations of western Christians with suspicion, if not with actual hostility. Education is as yet a luxury enjoyed by few, but the European schools established in the larger cities are drawing an increasing number of pupils and the government is developing an educational system. Perhaps the western physicians and their hospitals have had a greater influence than the schools, for they are desperately needed. With sewerage systems unknown, flies everywhere, water supplies unprotected from animals and refuse, it is little wonder that Persia is a disease-ridden country. In addition to an enormously large child mortality, great plagues of typhus fever and cholera sweep over the land, wiping out whole villages. Another great hindrance to progress is the Mohammedan custom of secluding the women in harems, where they learn little of the outside world and consequently have no opportunity to improve themselves or their homes.

"Young Persia"

Persia was long held back by the official class and by the priest class, which opposed all progress; but in the decade just before the World War it had an awakening largely through young Persians educated in

THE FAMILY OF DARIUS AT THE FEET OF ALEXANDER

Darius III, king of the Persians, himself escaped, but his wife, his mother, his three children, his harem, and hundreds of his men fell prisoners to Alexander the Great at the great battle of Issus, in 333 B. C., in which the power of the Persians was broken. The chivalrous courtesy with which Alexander treated his royal prisoners was a favorite subject among later Greek writers.

Europe, who made Paris the center of their plotting. In 1906, 16,000 people of Teheran accomplished a revolution by means that would seem to us extraordinary. They simply took refuge in the mosques and other holy places and in the British compound and camped there until the shah—up to that time an absolute monarch—agreed to grant them a constitution and an assembly with legislative powers.

Internal weakness and international jealousies, however, nipped Young Persia in the bud. By an Anglo-Russian agreement of 1907, Persia was divided into spheres of influence, the north falling to Russia and the south to England, and this agreement prevented Persia's doing anything for itself and blocked the reforms of W. Morgan Shuster, an American financier who was brought in, in 1911, to take charge of the country's finances. Successive assemblies were dissolved by force of arms. With the downfall of the Russian Empire, in 1917, this arrangement came to an end. By an Anglo-Persian treaty, concluded Aug. 9, 1919, the British government undertook to protect the independence and integrity of Persia, to furnish expert advisers for the Persian administration and equipment for a military force adequate to establish and preserve order, and to lend Persia money to carry out these reforms. Persia sent delegates to the peace conference at Versailles and is included in the list of states assenting to the covenant of the League of Nations. Whatever the English agreement may mean for the independence of Persia, it is sure to mean an improvement in order and a great commercial development, with corresponding benefit to the inhabitants.

A thousand years before Christ what is now Persia was in the hands of kindred agricultural and pastoral peoples—chiefly the Medes and Persians—whose speech was "Aryan" or Indo-European like our own, and whose religious beliefs and practices are pictured in the Zend Avesta of the great religious reformer Zoroaster (*see* Zoroaster). After a period of subjection to their Assyrian neighbors to the southwest, there came a brief-lived Median Empire (640–558), followed by a Persian Empire founded by Cyrus the Great (558–528 B.C.), ruler of one of the small Persian tribes under Median sway, who overthrew the king of the Medes and conquered all his empire. In 20 years Cyrus had extended his rule almost from the borders of India on the east to the Aegean Sea on the west, and to Egypt on the south. He was a wise ruler, whose aim was to soften by kindness the harsh rule which his sword was constantly extending. He allowed the Jews to return to Palestine, whence they had been carried as captives to Babylon, and encouraged them to rebuild their temple. When he fell in battle against a nomad tribe in 528 he was laid to rest in a massive tomb that may still be seen near the city of Persepolis, the ancient Persian capital.

Cambyses, the son of Cyrus, added Egypt to the immense Persian Empire. To Darius the Great, who succeeded to the throne in 521, fell the task of organizing the Persian Empire. He divided the greater part of his domains into 20 provinces, each ruled by a governor or "satrap," and each retaining a large measure of local freedom. He built roads from end to end of the empire and established a system of royal posts. By organizing a great Phoenician war fleet in the eastern Mediterranean, he made Persia the first great Asiatic sea power.

The decline of the Persian Empire begins with Darius' attempt to conquer the Greeks and extend his power to Europe (*see* Persian Wars). The great expedition of his son Xerxes in 480 B.C. suffered complete defeat at Salamis and Plataea. From then on the history of the Persian Empire becomes a fragmentary record of murders, palace intrigues, revolts, base betrayals, and disasters, culminating in the amazing conquest by Alexander the Great.

Alexander broke the power of Persia in the battle of Issus, in 333 B.C. The entire Persian camp fell into the hands of the conqueror, and the Persian loss in killed and prisoners was enormous. Darius fled to Babylon, whence he sent an embassy to Alexander offering to divide his empire with him. But Alexander demanded unconditional submission, which Darius could not give. He spent two years raising a new army, estimated at 1,000,000 men, but was again defeated at Arbela, and soon afterward was murdered by his own traitorous followers. With his death the ancient line of Persian kings came to an end, and with it the Persian Empire.

About a century after the death of Alexander, Persia passed from the hands of his Macedonian successors into those of the Parthian kings. These were soon followed by native Sassanid rulers, of whom Chosroes II (590–628 A.D.) even threatened Constantinople. Mohammedanism won Persia religiously and politically soon afterwards, and Persian art and literature flourished under the Arabian califs. Firdausi, "the Homer of Persia" (940–1020 A.D.), the greatest poet of his country, sang in epic verse of Persia's early kings. Omar Khayyam (died about 1123), whose contributions to astronomy and mathematics were among the greatest achievements of his age, also left a collection of poems (the 'Rubaiyat'), familiar to us in the splendid verse translation of Edward Fitzgerald. The tales of the 'Arabian Nights' also took shape on Persian soil. But the land became involved in the conquests of Genghis Khan and Tamerlane, of Turks and Mongols. Under the Sufi dynasty, of which Abbas the Great (1586–1628) was the most noted member, Persia's power and prosperity revived; and Nadir Shah (1736–1747) even invaded India. The present Kajar dynasty, which came to the throne in 1797, has witnessed a steady decline in power, prestige, and territory, so that Persia today is a mere ghost of its former greatness.

PERSIAN GULF. An arm of the Indian Ocean three times the size of Lake Superior thrusts up between Persia and Arabia to form the Persian Gulf. It has been an important body of water since ancient times. For Russia it is an outlet to the southern sea; for England it is a strong link in the route to India; Germany coveted its control as part of her scheme for world power; and the existence of rich oil fields about its head are an additional cause of international rivalries. The outcome of the World War, however, so strengthened the hold of Great Britain in this part of the globe that the Persian Gulf may now be regarded—equally with its neighbor the Red Sea—as practically under British control.

The Arabs called the gulf the Green Sea, from the color given it by great numbers of tiny sea animals. The Strait of Ormuz, 30 to 60 miles wide, connects it with the Gulf of Oman, which opens directly from that part of the Indian Ocean known as the Arabian Sea. The coast is flat and sandy on the Arabian side, high and steep on the Persian side. At the head of the gulf the waters of the Tigris and the Euphrates flow in through what is known as the Shat el-Arab. Since the days of the Macedonians, the Persian Gulf has been noted for its fine pearl fisheries, which today center chiefly around the Bahrein Islands and are said to yield annually millions of dollars in pearls and employ thousands of natives. The gulf is 520 miles long and 150 to 200 miles wide, and has an average depth of about 200 feet.

HOW EUROPE *was Saved from* ASIATIC CONQUEST

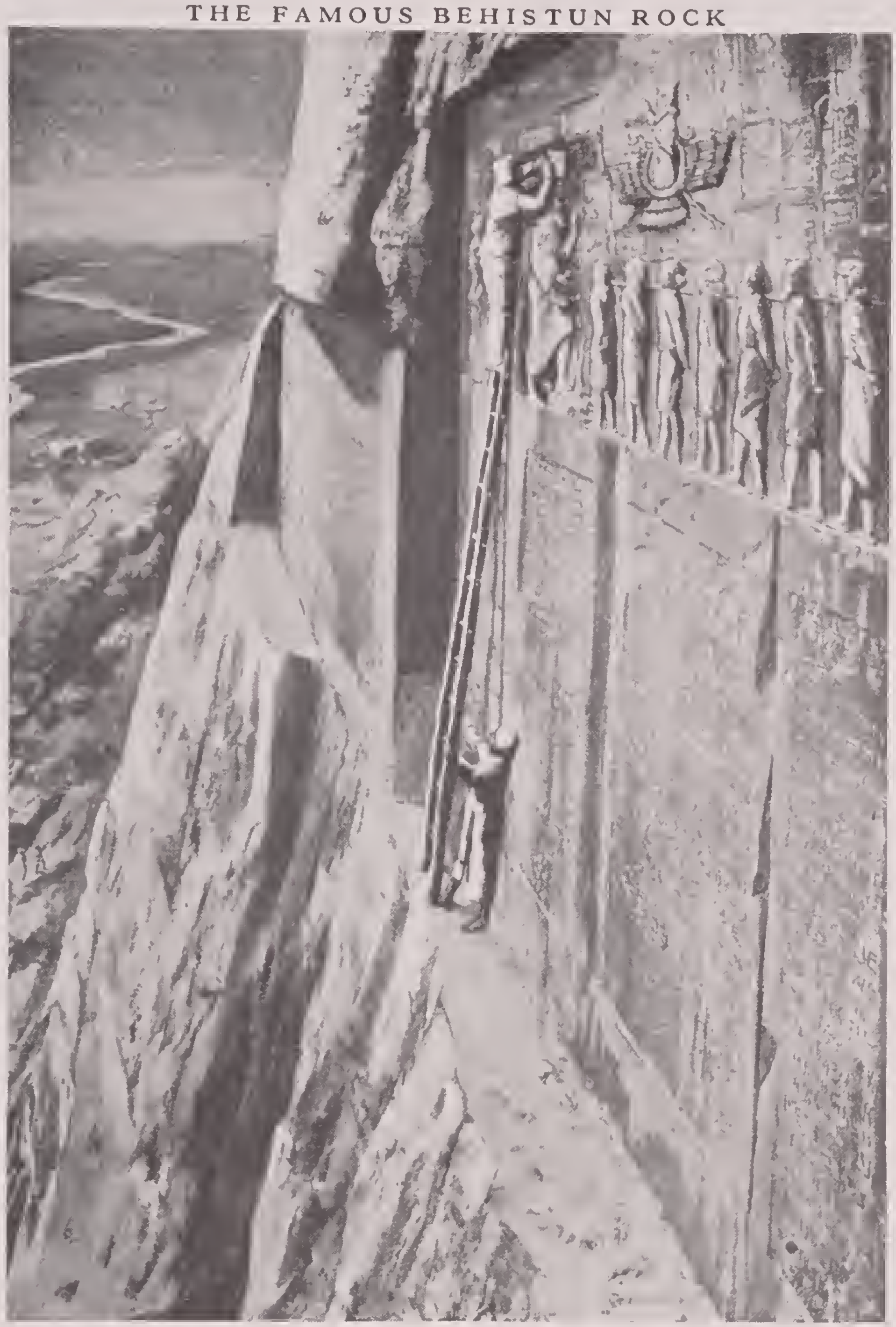
The Effort of the Persians to Conquer Ancient Greece—The Story of Marathon and Salamis, Decisive Battles in the History of the World—The Heroic Tale of Thermopylae, where 300 Gallant Spartans Checked the Persian Hosts

PERSIAN WARS. One of the most momentous epochs in the world's history was the second decade of the 5th century B.C., when the vast Persian Empire, then at the height of its power, attempted to carry its conquests into Greece and thus extend Asiatic despotism to Europe. If the Persian kings had succeeded, the whole course of history might have been changed and the progress of civilization stayed for centuries. The fate of Europe lay in the hands of Greece, the little nation whose position made it then, as it has at times been since, a buffer state between Europe and Asia.

The first Persian monarch to proceed against Greece was Darius I (521–485 B.C.), called "The Great" because of his colossal achievements in organizing and ruling the vast empire won by his predecessors. Among his subjects were the cities founded by Greek colonists in Asia Minor. Some of these cities, aided by Athens, revolted against Darius, capturing and burning Sardis, the Lydian capital.

At news of the catastrophe, Darius was transported with rage. "Who are these Athenians?" he demanded. When he was told, he made a vow to take vengeance upon them, and, according to the story, he instructed one of his servants to remind him thrice each day: "Master, remember the Athenians!" He gathered an immense army to send against the Athenians, but the expedition was wrecked in attempting to round the rocky promontory of Mt. Athos on the wild Macedonian coast (492 B.C.).

THE FAMOUS BEHISTUN ROCK



In the western part of Persia above the little village of Behistun, on a precipitous cliff towering 300 feet above the ancient highway, may still be seen this immense inscription—25 feet high and 50 feet wide—recording the triumphs of Darius the Great. To enable all his subject nations to read the inscription it was carved in three languages—Persian, Babylonian, and Susian—all in the curious cuneiform or wedge-shaped characters. Above the inscription is the figure of Darius himself, his foot upon the body of a usurper of the throne of Persia, whom he had overcome and slain. In 1835—more than 23 centuries after it was placed there—Sir Henry Rawlinson, an English officer and scholar, discovered the inscription. The perilous height was scaled and wet paper impressions or "squeezes" were made. After several years of study Rawlinson deciphered it, thus rolling back the curtain of the past and giving the world the key to the lost language and history of ancient Babylonia and Assyria.

A second army was sent in 490 B.C. Arriving in safety, it drew up on the plain of Marathon, a short distance northeast of Athens. The Athenians were brave soldiers, but they were seized with terror and despair when they looked down from the hills and saw encamped on the plain this great army that had never known defeat, flanked by hundreds of vessels drawn up in the adjoining bay. Could they withstand so mighty an enemy?

Some encouragement was given by the arrival of 1,000 Greeks from the little city of Plataea who came to their aid. After several days of waiting, the Athenian general Miltiades, believing that the contest must be decided now or never, gave the order to advance. Raising their war-cry, they rushed toward the Persians, who looked upon them as madmen thus to run into the jaws of death. But the invaders were soon undeceived. Miltiades had drawn up his men so as to have the greatest strength in the wings. The Persians, as he had expected, succeeded in driving back his center, but the two wings closed in on either side and threw the enemy into confusion. Hemmed in between the two lines of Greeks, the Persian bows were of no avail, while the stout Greek spears spread death and terror. Under the shock the Asiatics' line crumbled and they were driven in panic to their ships. Their loss was about 6,400 men, against only 192 on the side of the Greeks. Thus ended the epochal battle of Marathon—one of the decisive battles of the world—in which the Athenians for the first time averted Oriental domination.

Still undismayed by this defeat, Darius began preparations for a third expedition, but before he had finished he had to turn his attention to an insurrection in Egypt. Next year he died, leaving the punishment of the presumptuous Greeks to his successor Xerxes.

The proud handsome Xerxes would gladly have spent his days in luxury, but when at last he decided to proceed against the Greeks, his preparations were on a stupendous scale. To avoid such a shipwreck as had befallen his father's first expedition, he caused a canal to be cut through the isthmus of Mt. Athos—an undertaking requiring the labor of great numbers of men for three years. Then he caused a bridge of boats to be thrown across the Hellespont to connect Asia with Europe. This was destroyed by violent storms; whereupon, it is said Xerxes ordered the Hellespont to be lashed with whips and the engineers put to death.

Two new bridges of boats were built; and at last all was ready for the passage of the great host (480 B.C.). What a sight that must have been! The army included a motley of 46 different nations and tribes—nomad hordes of Asiatics, armed with daggers and lassos; Libyans, wearing on their heads the skins of horses' heads, on which the ears and mane were left to terrify beholders; Ethiopians, with their bodies painted half white and half red; men of all colors, dress, and arms, urged on by the lash of their officers. So enormous was the army, the historian Herodotus tells us, that seven nights were required for the crossing. Modern historians believe, however, that Xerxes' army could not have numbered much more than 200,000 men in all.

On his way toward Athens, Xerxes found a little force of Greek soldiers under the leadership of Leonidas, king of Sparta, stationed at the narrow pass of Thermopylae, which guarded the way from Thessaly to central Greece. Surely this handful of men would not dispute the way with his mighty forces, he thought. He sent a message summoning the Greeks to deliver up their arms. "Come and take them," replied Leonidas defiantly.

The Persians, advancing to the attack under the lash of their officers, were held back for two days by the long spears and unbroken ranks of the Greeks, in spite of their superior numbers. Xerxes began to despair of forcing the pass, when a traitorous Greek told him of a roundabout path over the mountains. When Leonidas found that the enemy were approaching from the rear and that the end was at hand, he dismissed his men except the 300 Spartans, bound like himself to remain at their post and conquer or die.

Leonidas was one of the first to fall. Around the body of their leader the gallant Spartans fought desperately, defending themselves, as Herodotus tells us, first with their swords, then with their hands and teeth, until they were overwhelmed and slain to a man. Afterwards a marble lion was placed on the spot in honor of Leonidas (whose name means "the lion's son"). Another monument was erected to the memory of the Spartans and inscribed with these words:

> Go, tell the Spartans, thou that passest by,
> That here obedient to their laws we lie.

The Final Defeat at Salamis

When Xerxes reached Athens, he found that the Athenians, following the advice of the great statesman Themistocles, had abandoned the city. Their ships, which had already suffered severely in an engagement off Artemisium, on the northern coast of the island of Euboea, were drawn up in the narrow strait between the island of Salamis and the southern coast of Attica. Xerxes set fire to the city, and while the flames reddened the sky took his seat on a marble throne upon a height overlooking the sea to watch the battle. He expected that his splendid fleet would win an easy victory, but again and again he started up from his throne in rage, as one after another of the Persian vessels was sunk or crippled by the impetuous onslaught of the Greeks. Though his ships outnumbered the Greek vessels three to one, they were so heavy and so crowded in the narrow strait that they moved with difficulty and fell an easy prey to the lighter Greek ships, which followed the new tactics of rowing out from a circular formation and ramming their prows violently into the clumsy enemy vessels. Two hundred of the Persian ships were sunk, others were captured, and the rest turned and fled.

Leaving part of his forces in command of one of his generals, the terror-stricken Xerxes hastened back to Persia. A few months later the Persian army was scattered at Plataea. No Persian army ever again set foot in Greece. Europe was saved from Persian conquest and domination.

PERSIMMON. In the Southern states there is no fruit more choice and luscious than the persimmon when the frost has taken away its harsh puckery taste. The persimmon is distinctively a southern tree. It will grow on the poorest land, and the fruit is very nutritious and well liked by domestic animals. It may be found as far north as Long Island or southern Connecticut, but only from Virginia southward will it be seen fully developed. There it grows from 20 to 30—and occasionally in the forest to 60—feet high. It has twisted branches and a handsome round-topped head of shining dark green leaves. The fruit when ripe is orange, often red-cheeked, and about the size of a plum. Its bitter taste before the frost has nipped it is due to the tannin it contains. Some varieties ripen before frost. Although it belongs to the ebony family, the persimmon is not an important lumber tree. Its wood is used for shoe lasts and handles. Scientific name, *Diospyros virginiana.*

The Japanese persimmon (*Diospyros kaki*), whose fruit is larger and better, is one of the principal fruit trees of Japan and is seen there in every garden. It is now cultivated in the southern United States.

PERSPECTIVE. As you look out along a railroad track, the rails, which you know are parallel, appear to meet at a point in the distance. The trees and telegraph poles appear to grow smaller as they recede farther and farther from your eye. If you were to draw this scene just as you see it, you would be making use of "perspective," which is the art of representing on a plane surface objects as they appear in space.

The ancient Egyptians and Assyrians knew nothing at all about perspective, as we can readily see from the drawings that have come down to us. The Greeks and Romans understood something of the art but it was forgotten or fell into disuse during the Middle Ages. This accounts for the queer flat appearance of the early Italian paintings. With the Italian Renaissance—especially the researches of the architect Brunelleschi and of that universal genius, Leonardo da Vinci—came the rediscovery and first real understanding of the principles of perspective.

The LAND *of the* INCAS *and Its* TREASURES

Great Storehouses of Natural Wealth in Peru that the Spaniards Missed and which Modern Enterprise is Developing

PERU'. The glamors of a storied past, of fabulous wealth, of scenery romantic beyond description, of mysterious and unexplored rivers and forests, of marvelous contrasts of climate and topography, still make Peru a name to thrill the adventurous, as in the old days when Spanish *conquistadores* invaded the land in search of treasure.

This republic on the western coast of South America has been favored by nature with such a diversity of mineral wealth, soil, and climate that there is scarcely a product of any clime which cannot there be found or produced in unsurpassed excellence. But the difficulties of communication caused by the giant ranges of the Andes, the systematic oppression and ruthless slaughter of the native population, and the incapacity of the Spanish conquerors and their descendants for the tedious and plodding labors of the pioneer have left the vast resources for the most part undeveloped. What the ruling classes of the republic have failed to do in the work of development is now being undertaken by more practical, patient, and resolute engineers of Europe and the United States. Foreign capital is flowing into the country, and foreign initiative is setting great enterprises on foot.

THESE TWO ARE "CHUNCHOS"

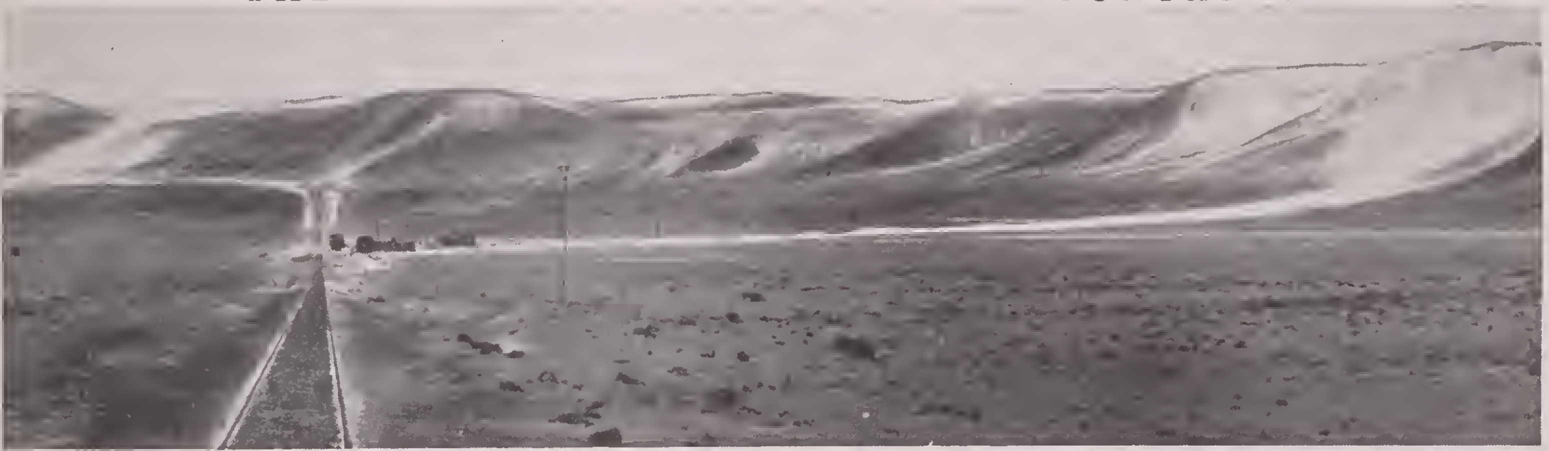
"Chunchos" is merely the Spanish name for the natives of the eastern "montaña" or forest zone of Peru.

The traveler who has pictured the coast of Peru as covered with tropical vegetation like that of the Atlantic side of South America is astonished to find here an arid, dreary, treeless coast strip, 20 to 30 miles wide, save for a few green river valleys at wide intervals. Rain rarely falls in this region, for the towering summits of the Andes intercept the moisture-laden trade winds from the southeast and the precipitation is all on the eastern slopes.

For a large part of the year, however, the coast is bathed by heavy mists, caused by the cold Antarctic or Humboldt current which sweeps up from the south. As is the case all along the Pacific coast of the American continent, good harbors are few.

Towering above this narrow coast strip, which is the seat of some of the largest towns, are three ranges of the Andes mountains, interposing a formidable barrier between the coastal zone and the vast forest region drained by the Amazon. Peru thus falls naturally into three zones: the coast zone; the "sierra," or great table-land lying in the valleys between the three ranges of the Andes; and the "montaña," or river and forest zone, on the eastern slopes. The coast zone comprises about one-tenth of the total area. The sierra occupies about a fourth part, and the forest zone the rest. Boundary disputes with her neighbors make the area of Peru uncertain, but including the regions to which its claim is strongest the area is about 722,000 square miles, with a length of about 1,000 miles and an average width of 700 miles. An enormous river system, perhaps the most remarkable in the world, breaks through the eastern chain

THE STRIP BETWEEN SEA AND MOUNTAINS



This is one of the two important railway lines of Peru; it runs from the coast by way of Arequipa to Lake Titicaca and to Cuzco, chief city of the Incas. The other railroad runs from Lima eastward into the Andes. Both of these lines cross the barren coast strip, which looks as if it could support no life of any kind, but they also tap the rich mineral resources of the mountains.

of the Andes and flows through impenetrable jungles to form the Amazon. Of these rivers the greatest is the Marañon, generally taken to be the true source of the Amazon.

The three divisions of Peru differ so widely in climate, products, and population that they form in effect worlds to themselves, and the inhabitants of one find it difficult to adapt themselves to conditions in the others. The differences are made greater by the difficulties of communication, for many of the upland cities are accessible only by rough and precipitous mule trails, while the huge forest region has no routes of travel except those furnished by its waterways.

ON THE ROOF OF THE ANDES

Lake Titicaca lies 12,644 feet above sea level, the highest point in the world where steamers are found.

Little Gualiaca, which lies 14,000 feet above the sea, is one of the loftiest towns on earth. In the foreground is a farm, with its fields separated by walls of mud and clay. It is so cold here all the year round that only potatoes can be raised.

What More Water Would Do for Peru

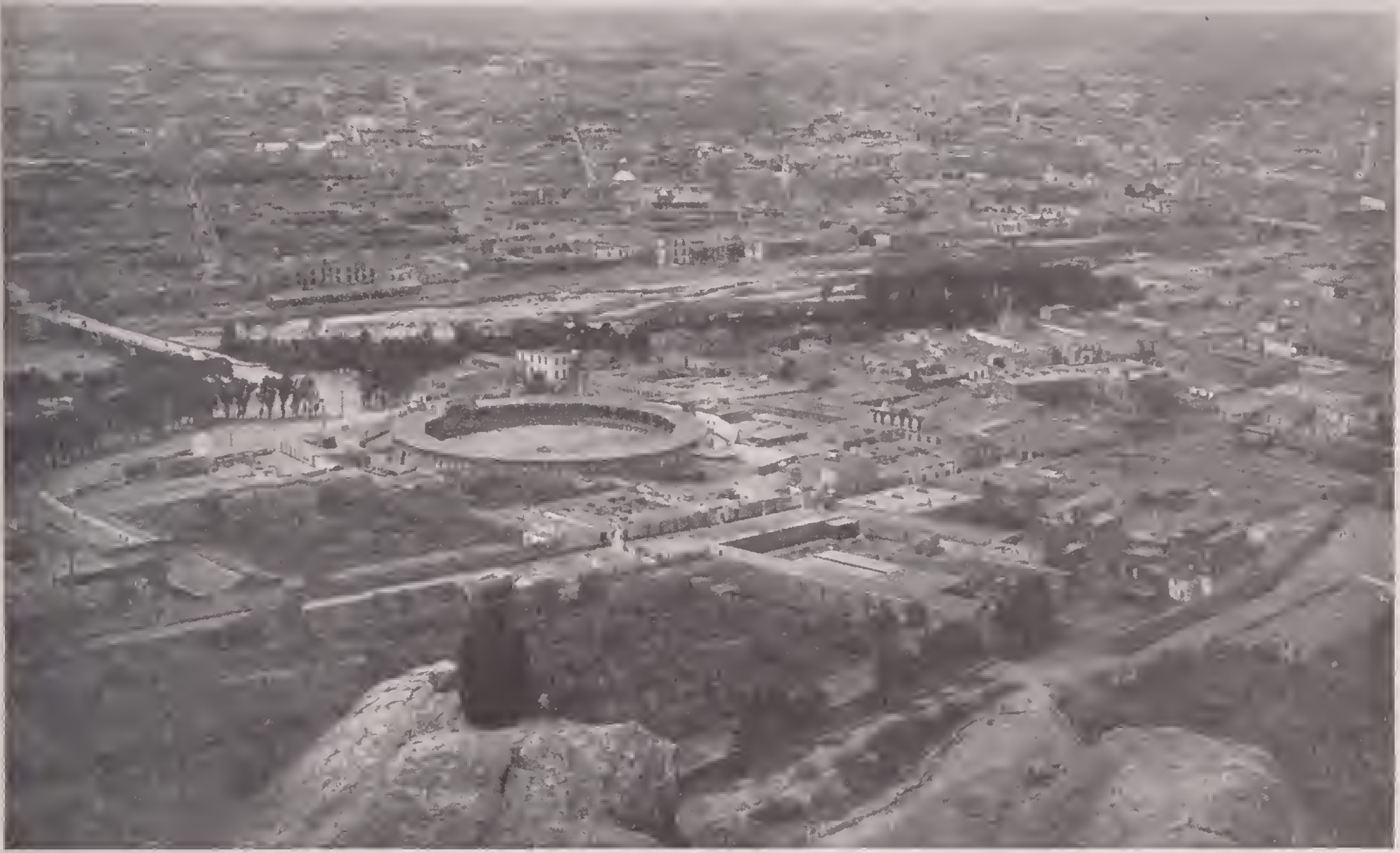
The coast towns, with the valleys of the few rivers that flow into the Pacific, are the center of the commercial, intellectual, and political life of Peru. In irrigated stretches are grown sugar and cotton, two of Peru's chief exports, with rice, tropical fruits, and vineyards. Of the 50,000,000 acres available for cultivation along the coast, only a small fraction are now productive, because of the lack of irrigation.

The plateaus and valleys of the sierra, with their more bracing climate, contain a great extent of fertile soil, but much of it can be cultivated only by terracing the steep hillsides as did the ancient Incas. Coffee, corn, wheat, barley, potatoes (which came originally from this part of South America), alfalfa, *coca* (a shrub from whose leaves cocaine is extracted) flourish at various levels from 5,000 to 12,000 feet. Through the entire length of the sierra region are immense grazing lands, on which cattle and sheep are raised, as well as flocks of alpacas and the most useful of all the Andean animals, the llamas (*see* Llama). The wools of these animals furnish much of the clothing of the country and are also exported in considerable quantities.

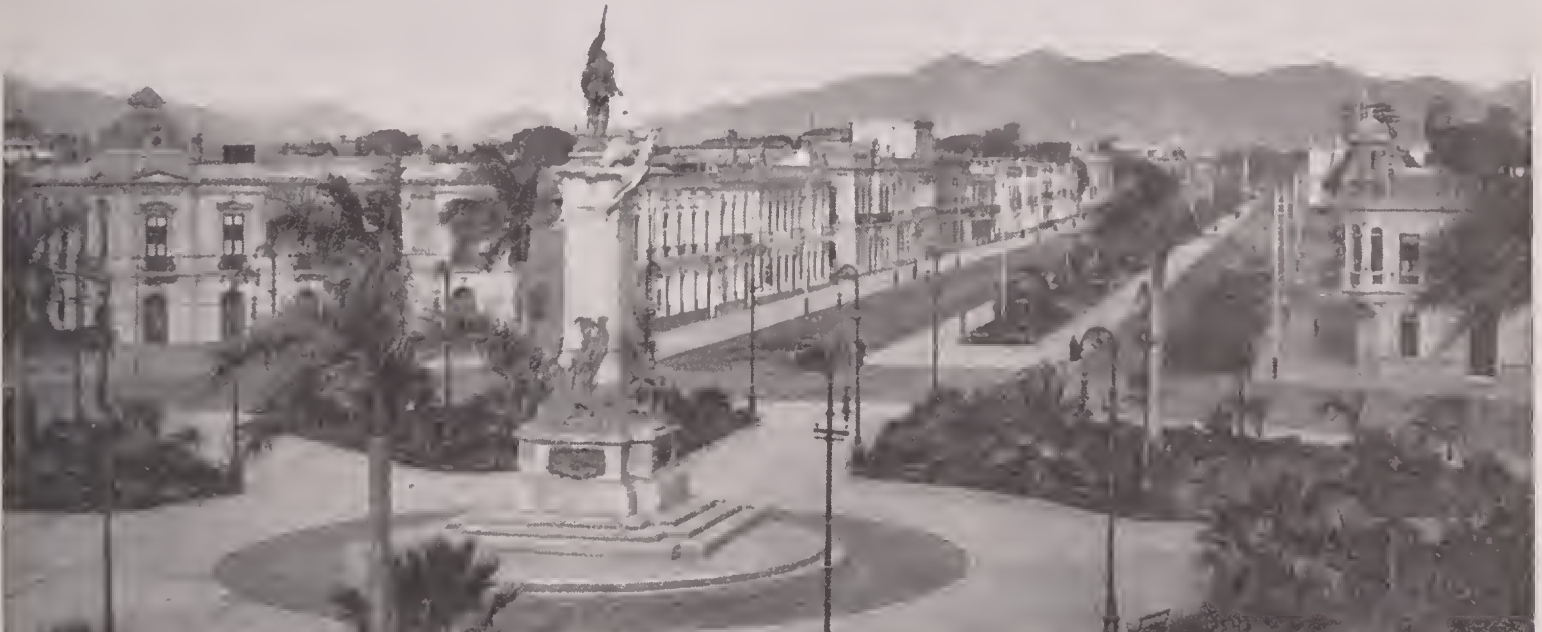
On the temperate eastern slopes of the Andes and in the tropical river valleys are vast tracts of territory, for the most part undeveloped, on which abundant harvests of almost every known crop could be raised in a remarkably short time. "It is sufficient to cut down and burn the brush and scratch the soil and sow with any seed, to recover returns of a hundred for one," says one authority. Most of the products of the tropics—sugar cane, cacao (the source of chocolate), cotton, and coffee—are here cultivated, but the difficulty of transportation greatly retards development. The forests of valuable woods in this district cover two-thirds of the entire area of Peru. The rubber forests appear inexhaustible but are difficult of access; and the rubber trade has left an indelible stain on the country because of the unspeakable cruelties inflicted on the native workers in the Putumayo region. Another famous product is quinine, made from the cinchona tree, which used to be known as "Peruvian bark."

The mountains contain minerals of great variety and extent. Copper, silver, coal, iron, quicksilver, lead, sulphur, zinc, and many rare metals occur in abundance. The production of petroleum, which is found near the seashore, is rapidly increasing.

ONE OF THE OLDEST CITIES IN THE NEW WORLD



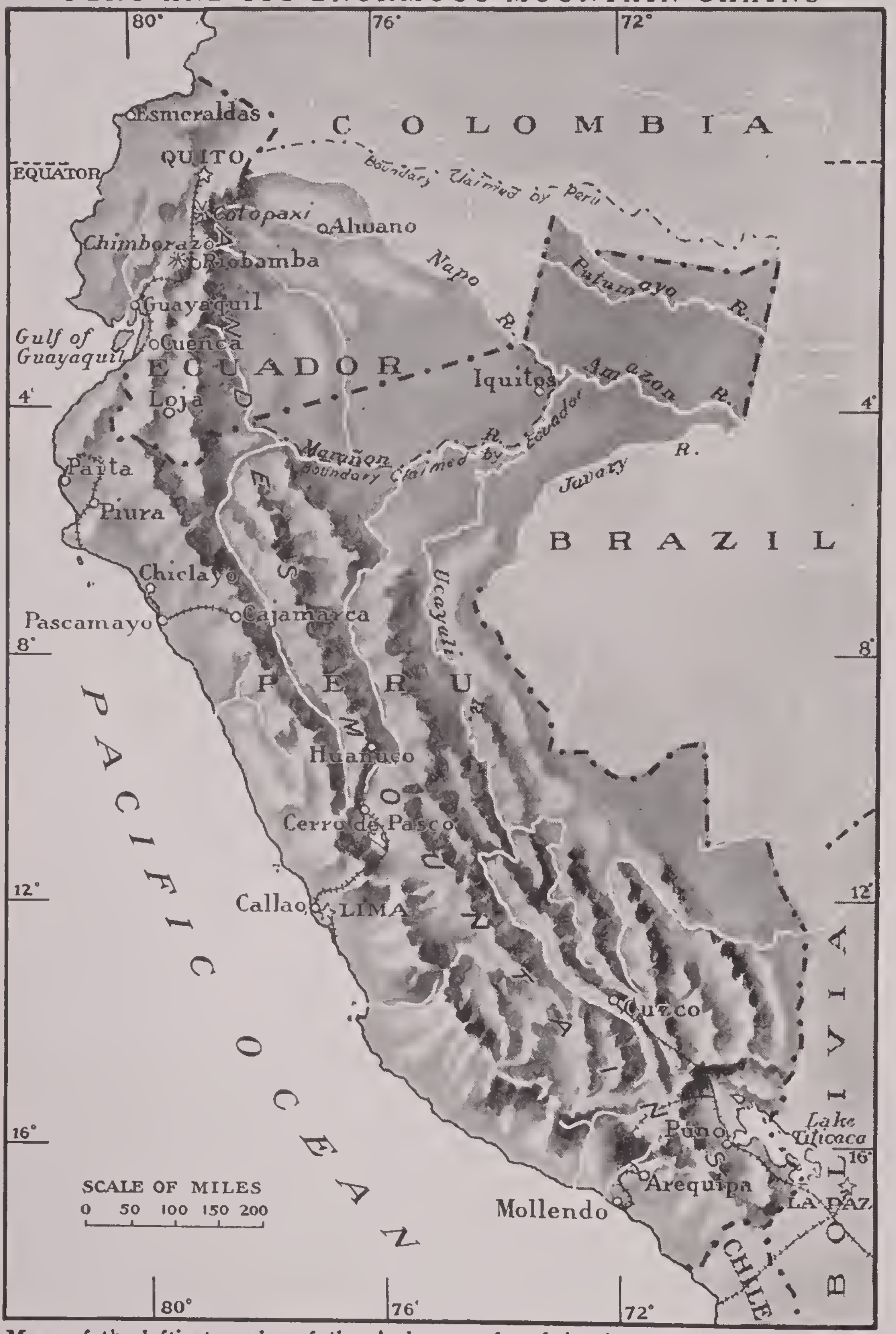
Lima, the capital of Peru, is also its largest city. Its most conspicuous feature here is that great bull ring near the middle of the picture. But Lima also boasts of the University of San Marcos, the oldest in America, founded in 1551. To the left we see a bridge over the Rimac River. This river runs into the sea seven miles from Lima. This photograph was taken from the hills which border the city on the north.



The palms waving in the breeze reminds us that Lima is really in the tropics. It is about as tar south of the Equator as Jamaica is north. Rain is all but unknown here, but the atmosphere is very moist, and in winter dense fogs prevail. This little beauty spot in the heart of the city is one of those typical squares or "plazas" which show the Spanish influence. This one is called Plaza Colon, which means Columbus Square, and the monument is a memorial to the great discoverer.

To open up these enormous agricultural and mineral resources, transportation is the chief thing needful. It now takes a journey of 17 days by rail, mule-trail, and water to go from the capital Lima, near the coast, to Iquitos, near the source of the Amazon—a distance of 1,224 miles, or less than the distance from New York to Omaha. The various short railways of Peru total about 1,750 miles. The 4,000 miles of waterways, navigable for vessels of eight-feet draft, and the pack-trains of mules and llamas are the only other means of transport. On Lake Titicaca, between Peru and Bolivia, steamers ply at the highest altitude in the world.

PERU AND ITS ENORMOUS MOUNTAIN CHAINS



Many of the loftiest peaks of the Andes are found in those great central ranges which form Peru's backbone. The northern boundary of the country has been for years a source of dispute with Ecuador.

Sugar and cocaine rank first among the manufactures of Peru, which are not extensive. High speed mills of the latest type, which are replacing the old machinery in the sugar factories, are greatly increasing production. The cocaine from Peru largely supplies the world's demand. Lima, the capital and largest city, manufactures cotton and woolen textiles, sugar, cocaine, and tobacco (*see* Lima, Peru). Arequipa, the second city, has cotton and flour mills, chocolate factories, and leather manufactures. The chief ports are Callao, six miles west of Lima, and Mollendo in the south. From Paita, in the extreme north, is exported the petroleum of northern Peru. Cuzco was the chief city of the Incas, who obtained gold from the mines and stream gravels in the region. Cerro de Pasco, about 100 miles northeast of Lima, at an elevation of more than 14,000 feet, is one of the highest and greatest mining camps in the world; copper has now replaced silver as the chief mineral of the district.

The population is estimated at about 4,500,000, of which more than half are pure Indians. The whites compose about 13 per cent, 25 per cent are of mixed blood, and there is a sprinkling of negroes, Chinese, and Japanese.

Peru contains many interesting remains of ancient Indian civilization (*see* Incas). Buildings of immense size, and beautiful pottery and implements, testify to the high degree of development attained. From its conquest by Pizarro in the 16th century (*see* Pizarro, Francisco), until its erection as an independent republic in 1821, Spain's rule over Peru was most barbarous. In 1824 a liberating army from Colombia under Gen. Simon Bolivar finally rid Peru of Spanish rule. Disorders followed and it was not until 1844 that a stable government was erected. In 1879 Peru, as an ally of Bolivia, became involved in a war with Chile. The naval conflicts of this war were watched with keen interest by all the great powers, because they were the first between modern ironclads. Peru was defeated, and lost the provinces of Tacna and Tarapacá, the latter rich in nitrate deposits. Peru has been slow in recovering from this disastrous conflict (*see* Chile). Political insurrections have further handicapped her. On Oct. 6, 1917, Peru severed relations with Germany because of German aggression on her commerce, and a few days later extended the use of her ports to the Allies.

Peru is a republic with a centralized government. The president, who holds office for four years, the two vice-presidents, and the members of the Senate and House of Deputies are all elected by popular vote. The Roman Catholic faith is the state religion.

PETER, SAINT. "Follow me, and I will make you fishers of men," said Jesus to the two sturdy fishermen, Simon, called Peter, and Andrew his brother; and without hesitation they rose, pulled their nets into the ship, climbed over the side, and went with him. They knew him, having seen him in the crowd that gathered to listen to the great preacher, John the Baptist.

PETER THE GREAT
The Creator of the Greater Russian Empire

Peter became the most prominent of the Twelve Disciples, and in the meager accounts given in the New Testament of the lives of these men who went about with Jesus preaching and doing good, Peter's name is most often mentioned. With James and John he formed a little intimate group around Jesus, and with them was present at some of the great incidents of Jesus' life—the transfiguration on the Mount, and the last night before his crucifixion.

It was St. Peter, according to the gospels of St. Matthew and St. Luke, who first gave voice to belief in the divinity of Jesus—"Thou art Christ, the son of the living God." Peter was generous-hearted but impulsive; and he it was who, when men came to arrest Jesus, lifted his sword, although he was only one against a crowd, and smote wildly at the man nearest him, cutting off his ear. Yet only a few hours afterward, when Jesus had been led off to the house of the high priest, Peter denied that he ever had known him. Later he bitterly repented his denial, and it was to him that Christ first appeared after his resurrection, according to one version, with the command, "Feed my lambs."

Peter, thus assured that the Master still trusted him, grew daring and courageous, and became the great teacher in the early days of the church, preaching throughout Palestine, performing miracles of healing, and enduring great hardships and persecution. That he worked in Rome for a time is accepted by Catholics and many leading Protestant scholars. Roman Catholics count him as the first bishop of Rome and the first pope. His claim to the position of head of the church is based also on the words of Jesus to Peter: "Thou art Peter, and upon this rock (Greek "petros," meaning either "rock" or "Peter") will I build my church." After many years, according to tradition, the Romans took him prisoner in the reign of Nero and crucified him. Peter, impetuous as of old, declared he was not worthy to be crucified as was his Master, and asked to be crucified head downward, a request which the Romans readily granted.

The First Epistle of Peter was written by him; but the evidence as to the Second Epistle is not so clear. It is believed that the Gospel of Mark is derived from Peter's accounts of the life of the Master.

PETER THE GREAT (1672–1725). Russia has two faces: one is turned toward Asia, with the other it looks out on Europe. Its western face has never lost the features given it by the greatest of the Romanof family, Peter the Great.

In Europeanizing Russia, Peter owed something to his predecessors, who had made contracts with the western world and permitted traders and colonists to come into Muscovy, as Russia was called, and to settle in the outskirts of Moscow itself. It was to these colonists and to his French tutor that the boy Peter, neglected at court, turned to learn in the reigns of his older half-brother and sister.

In 1689 the ruthless boy of 17, a man in energy and decision, shut up in a convent the half-sister who had been acting as regent, and disregarded the feeble-minded half-brother who was supposed to be joint ruler with him. It seemed nothing short of insanity for a ruler to attempt to beat down the walls of tradition, custom, culture, religion, and geography that shut Russia off from the Europe of Louis XIV's day. But Peter did it almost single-handed. Brutal, barbaric, without scruple, without even a memory of kindness or conscience or morals, he whipped Russia into a place in the circle of European powers.

A MODERN LANDLORD WOULD HAVE THROWN HIM OUT!

When Peter the Great visited England in 1697 he leased Sayes Court, the estate of Sir John Evelyn at Deptford, which was near the shipyards Peter wished to study. Peter did much damage to Evelyn's gardens, which were among the most famous in England, and made it one of his chief amusements, so it is said, to ride in a wheelbarrow through a thick holly hedge which had been Evelyn's special delight. What did the Czar of all the Russias care about a garden?

Nothing could stop this volcano of human energy, and he stopped at nothing to reach his ends. He was as if driven by an inner fire and his activity was unceasing. He reformed the army, began the navy, crushed the church into subjection, introduced new taxes, forced European ways and dress on his reluctant nobles, furthered the introduction of western education, products, and processes, and sent abroad Russians to learn, while he brought in western Europeans to teach. Drunk or sober, he spared neither himself nor his people.

Peter not only drove but he led. He tried to learn everything himself, whether it was shipbuilding or tooth-pulling. He longed especially for a direct view of a civilization that would rouse his land from its isolation and Asiatic seclusion. So in 1697 he visited Europe, ostensibly as a subordinate member of a group of Russians who were to learn western ways; but it was Peter who did the learning. Prussia, Hanover, and Holland were visited, and in the latter country the czar himself worked in a shipyard. Three months were spent in England, and several hundred English engineers and artisans were added to the party. When the Russian party left, the English cleaned out the residences assigned them much as they would clean a pig-pen. Louis XIV avoided such a visitation by insisting that, as Peter was traveling incognito, he could not give him a royal reception. Peter therefore traveled on to Vienna; whence he was recalled by a plot of the royal guard (Streltsi) aided by the Old Russian party. After crushing the rising, Peter divorced his wife, who was thought to be in the plot.

The Founding of St. Petersburg

In 1703 he founded a new capital at St. Petersburg (now Petrograd), near the Baltic in the low land at the mouth of the Neva, won from the Swedes (*see* Petrograd). On a later visit to Europe, in 1716–17, all the forces that clung to the old Russia rallied behind Peter's son Alexis. The revolt was in vain, and the son died in prison from tortures.

In his external policy Peter determined to secure for Russia ice-free outlets to the sea, which he called "windows toward Europe." His first blow fell on Turkey in an effort to secure a foothold on the Black Sea. In 1696 he captured Azof, at the mouth of the river Don, only to lose it 15 years later.

In the meantime he had challenged Sweden, the greatest military power of the north, which in that day controlled the eastern end of the Baltic, Russia's other possible outlet. From 1700 to 1721 it was a duel between Peter the Great and Charles XII of Sweden. Peter's raw recruits were beaten at first, but they learned and Peter learned; and Charles was even more rash and impetuous than Peter and would not learn. At the battle of Poltava (1709), in southern Russia, Peter won a decisive victory. The war continued, each leader drawing to his support the other's enemies. Peter triumphed in the end, and by the peace of Nystadt, in 1721, Russia became a Baltic power, with a shore line on the south of the Gulf of Finland. A year later a war with Persia gave him a foothold on the Caspian Sea.

In 1712 he had married his mistress, and on his death in 1725, he made her his successor as Catherine I. Probably no ruler has ever left a greater impress on the land over which he ruled than did this czar, half brutal barbarian and half benevolent despot.

PETREL. "Mother Carey's chickens," as the petrels are called by sailors, wander over the oceans of the whole world. They live entirely on the sea, coming to shore only for a brief nesting season. Following every ship, weathering every gale, these strong-winged little birds are the pets of all seamen.

The name petrel means "little Peter," and it was given to the birds because their habit of "walking on the water" recalls the biblical story of the apostle Peter. The birds, however, always do their "wave-walking" upheld on spread wings, and the feat can scarcely be called walking, in the strictest sense.

Strange stories and superstitions are connected with the petrel. They are supposed by many to be under the protection of the Virgin Mary, and each bird is believed to represent the soul of a sailor lost at sea. Seamen believe that their appearance presages a storm; hence comes the name of a common species, the storm-petrel.

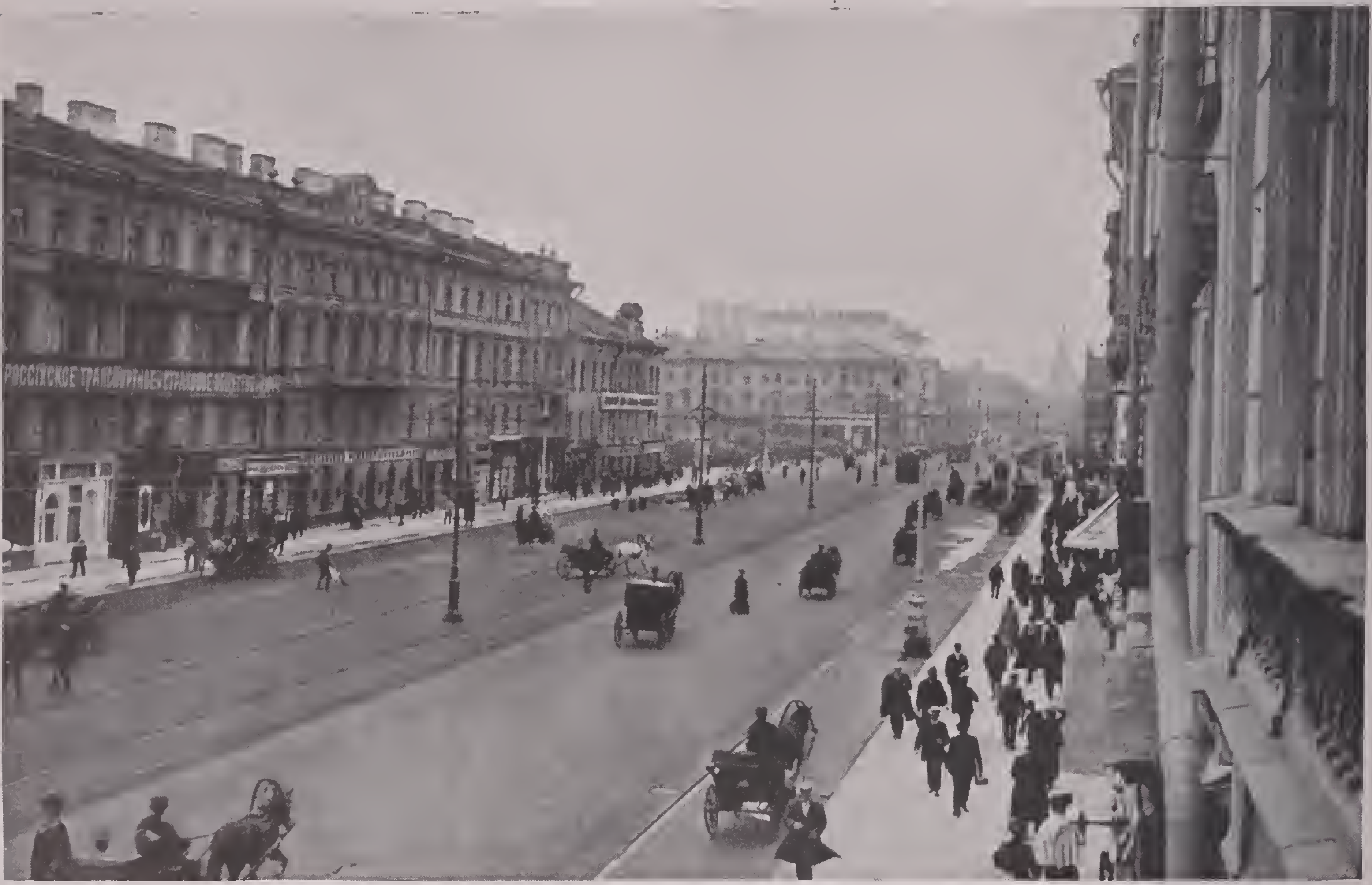
Petrels vary in size from the storm-petrel, 5½ inches in length, to the forked-tailed petrel, 9 inches long. The general color is brown or grayish-black; some species have a patch of white feathers at the base of the tail. Generally but one egg is laid, in a rocky crevice or in a burrow in some bank. The birds feed on small water animals or on any refuse cast overboard from ships.

There are about 70 species of petrels, which with their relatives the fulmars and shearwaters make up the family *Procellariidae* of the order of tube-nosed swimmers. Scientific name of storm-petrel, *Thalassidroma pelagica;* of forked-tailed petrel, *Oceanodroma furcata.*

PET'ROGRAD, RUSSIA. Peter the Great wanted "a window looking out on Western Europe," so he conquered the Baltic shore from Sweden and Livonia and built the city of St. Petersburg, which has been known as Petrograd since the World War of 1914–18. The site, on the banks of the Neva where the river empties into the Gulf of Finland, was a desolate marsh, and the difficulties of building were enormous. But human life was cheap, and thousands of peasants were brought there to die of disease and hardship as they sank the forest of piles for the city's foundation.

Before the fall of the czars, Petrograd was the realization of Peter's dream, and it is fitting that one of the traveler's most vivid memories of the city is that splendid statue of the man who more than any other created Muscovite progress. In the square before St. Isaac's Cathedral, whose glorious gold dome is always the first and last impression of Petrograd, sits Peter the Great, upon a horse whose hoofs trample

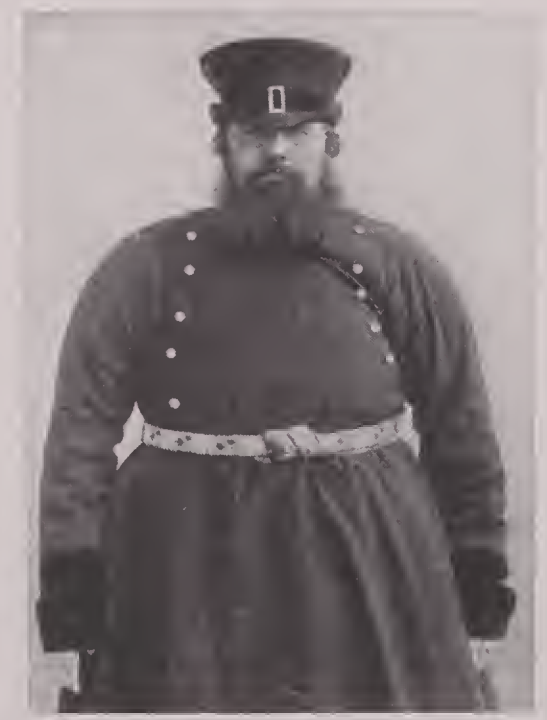
THE FINEST BOULEVARD IN RUSSIA



This is the Nevsky Prospekt, one of the world's famous streets. It is to Petrograd what Fifth Avenue is to New York, Michigan Avenue to Chicago, or Pall Mall to London. Its name means "view of the Neva," but the street runs alongside the river for only a part of its course.

a writhing serpent, symbolizing the iron will of the man who conjured this great city out of the swamps.

In the days before the Russian Revolution changed the face of all Russia, the Nevsky Prospekt, one of the longest and broadest of the magnificent streets of the world, was one of the most brilliant sights in Europe. Then Petrograd was the residence of the court and the aristocracy, and you would see dense throngs promenading the broad pavements—the fashionable world of officials, be-medaled military "personages," beautiful women wrapped in rich furs; tousled peasants and their kerchiefed womankind; the workmen in blue caps with a cloth peak, dark jackets, and trousers tucked into long boots. Cossacks in high black astrakhan hats and long coats flashed by on prancing mounts. Lacquered sledges flew swiftly over the dry crunching snow, and here and there you saw shabby sleigh-men standing in wooden-railed sleds plastered over with brass-headed nails, urging their weary little ponies ahead with flapping reins and noisy cries.



He is no grand duke, but a coachman of the days of the czars. His figure is not natural; he is padded. The more padding the coachmen wore, the higher was the social position of his master. This man was merely the driver of a public hack or "drosky."

The Nevsky Prospekt and the two other great avenues of the city radiate from the great Admiralty, the very heart of Petrograd. Across them, like the cross strands of a spider's web, run narrow streets and canals. Near the Admiralty are several other government buildings, including the colossal Winter Palace—the largest palace in Europe, housing 6,000 people. A gallery connects it with the Hermitage Fine Arts Gallery, which boasts one of the richest art collections in the world. From the vast stone-paved square before the palace you may look across the river to the dread fortress of St. Peter and St. Paul. You shudder to think of the anguish which has been endured behind those cold gray granite walls, at the summons of rulers now sleeping within a small cathedral, whose delicate spire rises far above the towers of the fortress inclosing it.

As you keep on down the Nevsky Prospekt, you stop before the high-pillared semi-circular approach to the Kazan Cathedral, one of the most famous of Petrograd's 400 churches. A screen in the old days shielded from common eyes the Holy of Holies, made of silver treasure rescued by Cossacks from Napoleon's booty-laden army on its retreat from Moscow.

On a neighboring island—much of the city is built on small islands—is the university, once the intellectual pulse of all Russia, with several other scientific and educational institutions. Back of it are the wharves and warehouses, where the tide of Petrograd's enormous commerce formerly flowed. A system of canals and natural waterways carry the commerce of the Neva as far as the Caspian and White seas, and this river is thus the principal channel for the trade of Petrograd with the rest of Russia; it carries, too, in normal times, much of Russia's prodigious export trade in grain, especially rye and oats, oil-seeds and cakes, flax, and timber, bound for western Europe and Finland. In the northern part of the city is a great region of factories where in pre-Revolution days textiles, Gobelin tapestry, glass, porcelain, clocks and watches, tobacco, leather, and many other articles were manufactured. Here too were huge iron works, shipyards, paper mills, sugar refineries, and other industries.

Petrograd is never a pleasant city to live in. The climate is cold and damp, and subject to sudden changes. Rain and snow fall nearly half the days of the year, and the Neva is frozen for six of the twelve months. In winter roadways are laid out across the thick ice to supplement the three permanent bridges. Terrible floods are frequent in spring, often inundating great areas of the low-lying city. The average temperature is 38.6°, with a six-weeks' summer.

Yet despite the drawbacks, Petrograd formerly attracted a large foreign population, and from all over Russia students came to the university and the many technical and special schools. "Less Russian than any city in Russia," it used to be called in the days when the Russian Empire still retained its grip, and when it was accounted one of the great intellectual centers of the world. Here broke out the great revolution of 1917, which swept the czar and his family from the palace to a nameless grave, and resulted after a second revolution in the establishment of the Bolshevik government. The capital was moved to Moscow a few months later and in the years of internal war and revolution that followed the once gay city became a ghastly corpse, with all shops boarded up and the inhabitants greatly reduced. Population before the World War, about 2,300,000; now between 500,000 and 750,000.

The "ROCK OIL" *that Turns a* BILLION WHEELS

PETRO'LEUM. In Mexico, the land of "gushers," a spouting geyser of oil at Cerro Azul towered higher than the Washington Monument and drenched the country for two miles around. The first blast of gas and oil wrecked the derrick, tore loose the two-ton drill bit, and threw it 125 feet away. Almost as sudden and spectacular in its way has been the rise in 60 years of the petroleum product business from nothing to an industry which now both lubricates and turns the wheels of our automobiles, motor trucks, motorcycles, farm tractors, warships, passenger liners, submarines, motor launches, and airplanes.

Yet "rock oil," as petroleum once was called, is no new discovery. The flaming wells and springs of Baku, Russia, holy city of everlasting fire, have borne witness to its existence since time immemorial. In various parts of the earth it has issued from the ground or been found in wells or as a scum over the surface of ponds and lakes. The Assyrians, Egyptians, Greeks, and Romans knew of it and made limited use of it as an illuminant, an ingredient in cements, and as an aid in embalming. The North American Indians used it to anoint their bodies and as a treatment for certain ailments; but the usually resourceful American colonists regarded it with deep disgust, or at best bottled it for sale as a nostrum, when they encountered it while drilling for salt.

The great Cerro Azul gusher in Mexico spouting oil at the rate of 100,000 barrels a day.

In 1826 a certain far-seeing Dr. Hildreth ventured the bold prophecy that "this product offers great resources as an illuminating agent and will certainly become of great utility in lighting the future villages of Ohio." Here and there a shop or a mill adopted it for lighting. But the odor and smoke of the crude oil made it unsuitable for household use and interfered with the first attempts to market it as a commercial product; and so petroleum went unvalued until after the discovery of "coal oil."

In the Days of "Coal Oil"

In the '40's kerosene or "coal oil" distilled from coal began to displace whale oil on the market. Experimenters soon found that a similar illuminant could be obtained by refining petroleum. The resulting demand for petroleum soon outran the supply obtained from brine wells and by skimming the surface of ponds, and a company was formed to bore for oil in Venango County, Pennsylvania. In 1859 a well driven for this company on Oil Creek by E. L. Drake struck oil. There followed the first and greatest of the many "oil booms," which have made millionaires by the score and paupers by the thousand, and the petroleum industry got under way. About ten years later the Standard Oil Company, which came in time to dominate the oil market, not in the United States alone but all over the world, commenced its successful career.

HOW AN OIL WELL IS DRILLED

The boring drill at the right, covered with mud and bits of rock, has just been drawn up, and the steel tube bailer, at the left, is being let down to gather the accumulation of water, mud, and rock cuttings. As the work progresses it is necessary to remove the drill from time to time, and clean out the hole.

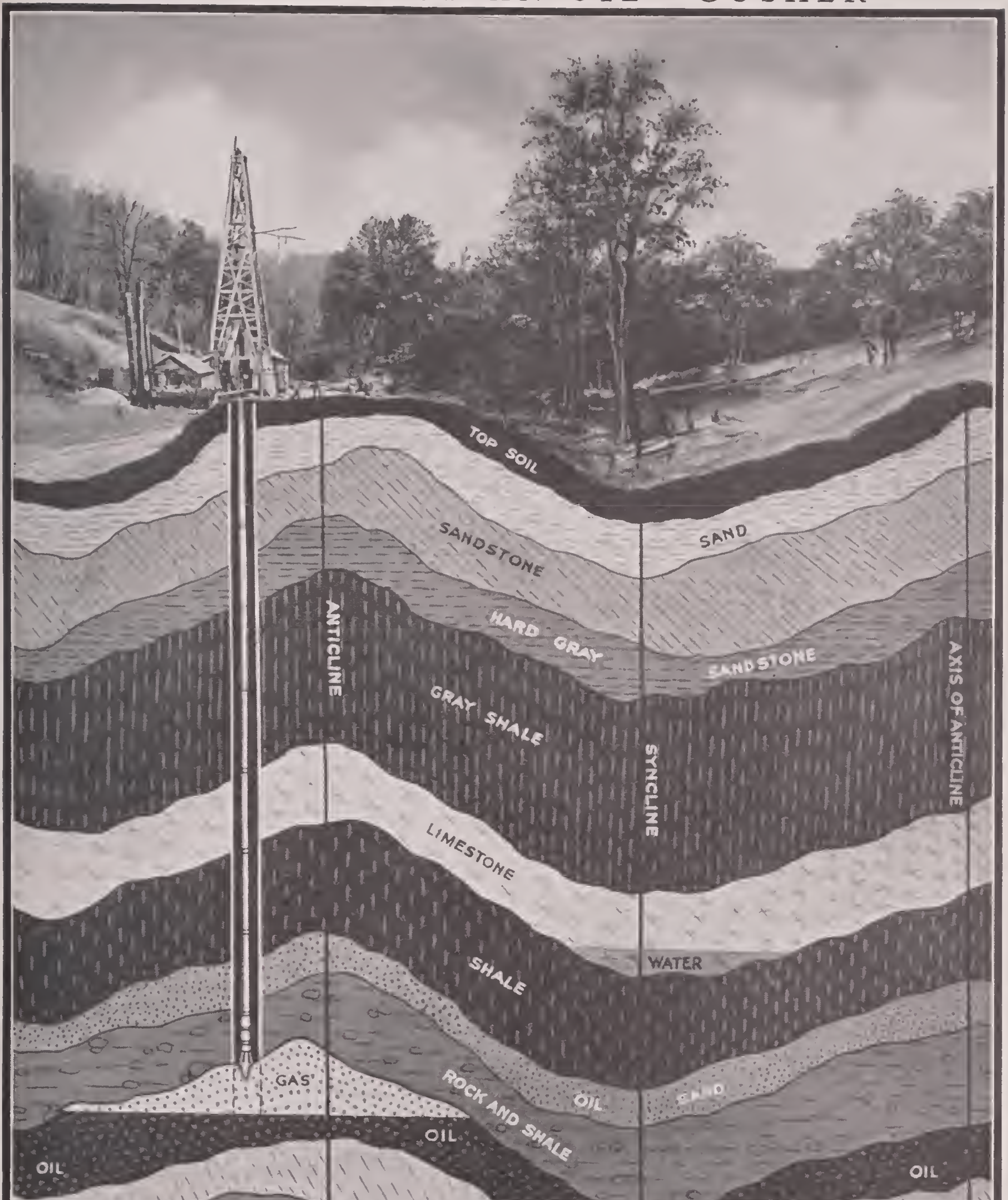
What is this wonderful substance which now is so important to the world? Crude petroleum is a mixture in varying proportions of many exceedingly complex hydrocarbons, with small amounts of sulphur, phosphorus, and other impurities. It belongs to the group of substances known as bitumens, the members of which may be gaseous, liquid, or solid (natural gas, petroleum, asphalt, and mineral wax or ozokerite) but are all of similar nature chemically. It varies in color from almost white through amber and greenish-brown to black, and in consistency from a fluidity like that of gasoline to a viscosity like that of tar or pitch.

Scientists disagree concerning petroleum's origin. Most geologists, however, believe both petroleum and natural gas to have been made by the age-long decomposition of organic matter confined under high pressure between layers of impervious rock. Since the resulting oils were fluid, they may have been shaken, forced, or drawn by capillary attraction into the reservoirs where they are now found, instead of being produced there in the first place. Their frequent association with salt deposits and salt water is one of many unsolved puzzles. It has suggested to some scientists that the organic remains from which petroleum is derived were supplied by the ocean.

But whatever its origin may have been, petroleum now exists in sedimentary rocks of practically all geological formations except the earliest and the latest. Not everywhere or in all formations, however, does it occur in commercial quantities. Obviously, the "oil springs," seepages, and other superficial indications which once served as clues to underlying oil will no longer do. Since drilling costs from $8 to $20 a foot, more accurate indications are needed. The oil prospector has therefore learned to listen with great respect to the advice of the geologist. Taking the advice of these scientists has reduced the proportion of dry wells driven to about a third of what it was under the older practice of "wild-catting" or random drilling.

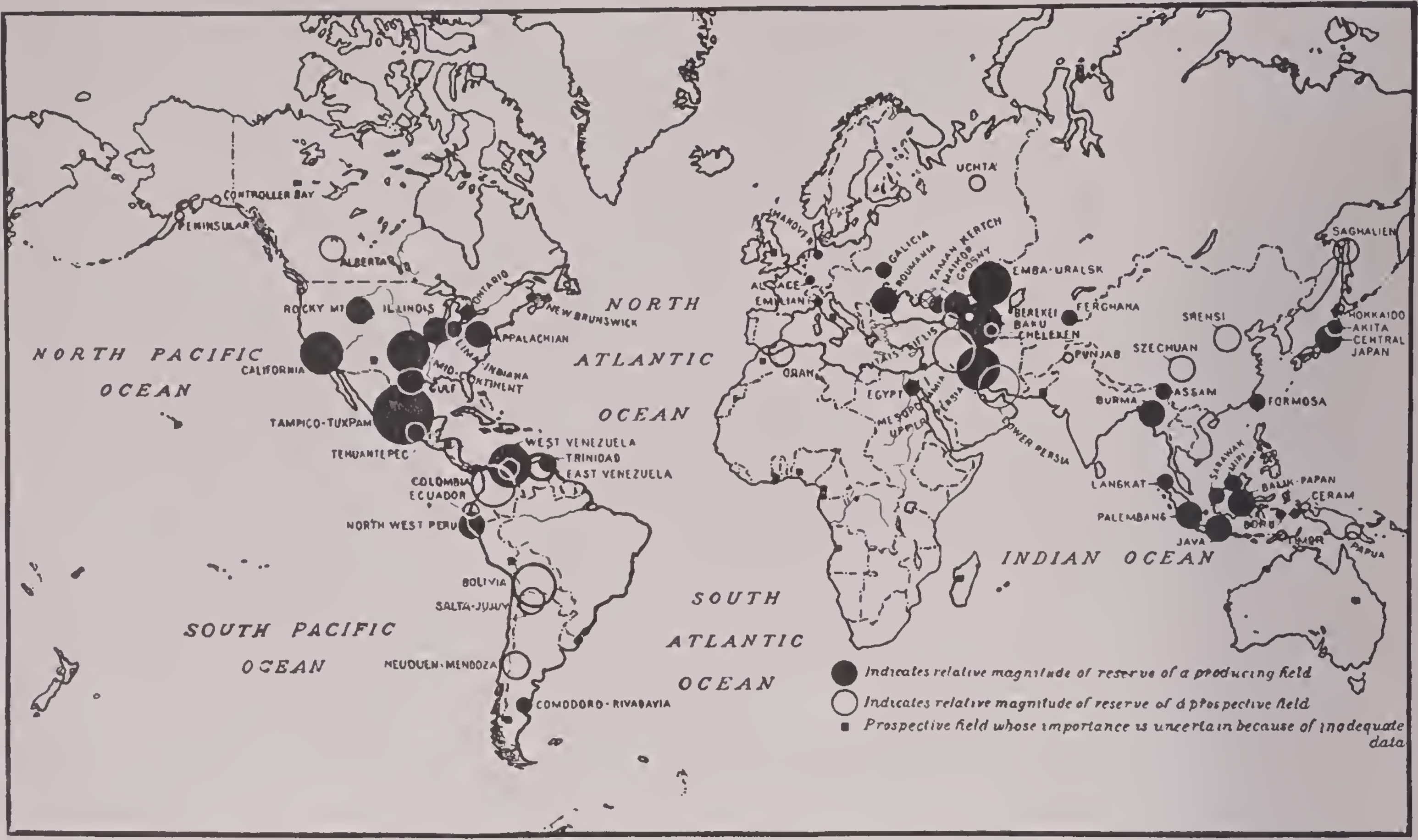
The world's commercial supply of oil is drawn chiefly from the comparatively ancient Devonian and

THE ORIGIN OF AN OIL "GUSHER"



Petroleum is often found beneath those great upfolds of the earth's strata called "anticlines." We can see here why this should be so. The lower layers consist of porous rock bounded above and below by impervious deposits. The oil and water have drifted down into this pocket from the surrounding portions of the earth's crust. The water being heavier fills the depression or "syncline," while the oil rises above into the "anticline" region, and above that perhaps gas gathers. When the drill pierces the impermeable "lid" of this age-old storage tank, the gas and oil gush upward, after the manner of an artesian well.

WHERE THE WORLD GETS ITS SUPPLY OF PETROLEUM



As the size of the black circles is determined by the relative importance of each petroleum field, you can easily see that there are today two great centers of production, the southern part of North America and the southeastern corner of Europe. In South America, the East Indies, Japan, India, and China are other fields, some of them of considerable importance, but it is doubtful if any of these fields will ever equal in importance those of the United States, Mexico, and the Black and Caspian Sea regions, the three leading petroleum-producing regions of the world.

Carboniferous (coal-bearing) formations, and the comparatively recent Tertiary (*see* Geology). Oil is often found permeating porous sandstones with natural gas above and salt water below. It is sometimes sealed into pockets or "pools" by domes of impervious rock, and is often subject to pressure which produces a "gusher" when the reservoir is first tapped. Such oil "pools" are of definitely limited extent. The famous Tepetate-Casiano pool of Mexico, which produced more than 75,000,000 barrels of oil in eight years, is about half a mile wide and three miles long. The oil region of Pennsylvania has been more thoroughly drilled than any other field; yet less than one per cent became producing territory.

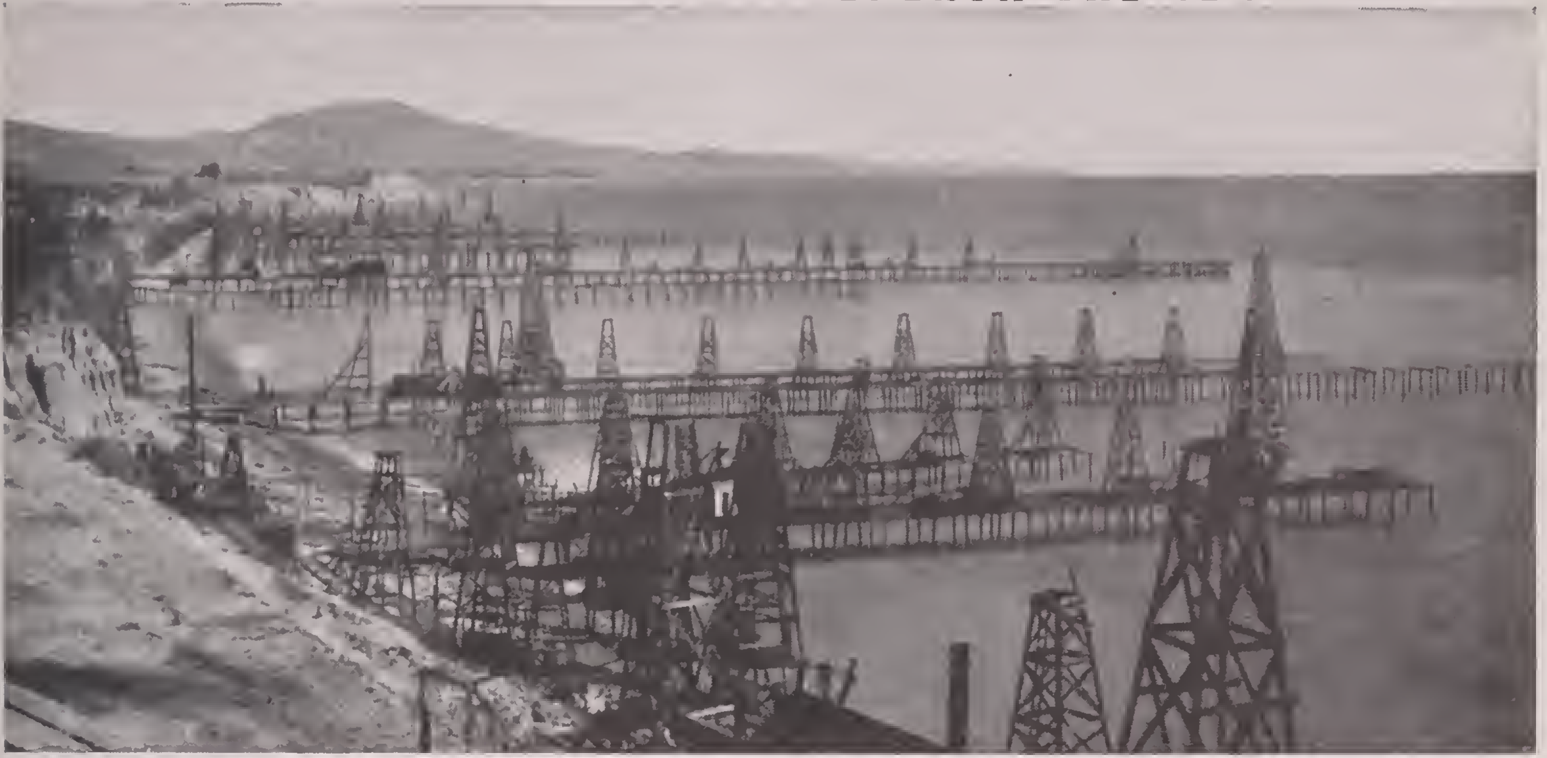
As might be expected, oil is found at many levels. The early wells at Baku were scooped out by hand to a depth of not more than 50 feet. In the United States productive wells have been drilled to depths of 3,000 and 4,500 feet. Oil may be found at various depths in the same field. Drake's first well struck oil at a depth of 79½ feet. Later and far more productive Pennsylvania wells struck oil in the "third sand" at depths between 400 and 500 feet. In Baku today wells side by side vary by hundreds of feet in depth. Oils from the same field but from different geological formations may vary widely in composition.

A modern oil field bristles with steel or wooden derricks—"rigs," in the oil man's phrase—from 30 to 136 feet high, according to the depth of the well beneath. They are often set in rows spaced with mathematical precision from 660 to 1,320 feet apart. Since oil is not, like solid minerals, stable under the ground, but may be drained from a comparatively large area by a single well, every neighboring landowner or lease-holder generally makes frantic haste to put down wells adjoining the one that has "struck oil." This habit of sinking more wells than are needed to drain the pool of course is wasteful.

In the United States oil wells are usually drilled by one of two methods. By the "percussion" or Pennsylvania cable tool method, a "string of tools" about 60 feet long and weighing perhaps 1,800 or 2,200 pounds, hung by a cable over a pulley, is raised and lowered at regular intervals with a stroke of three or four feet by a power-driven walking beam. This "string" gradually hammers its way downward through the rock. Casings of iron pipe are lowered as necessary to prevent the well from filling with water or earth.

The percussion method has been found intolerably slow in drilling deep wells through soft caving formations. The newer hydraulic rotary method makes it possible to reach in a few weeks levels which it would have required months if not years to attain by the older method. A heavy drill pipe, fitted at its lower end with a perforated "fishtail bit," is rotated so as to rasp a hole through the rock, while water or mud, forced down through the drill pipe, returns outside, thus plastering up the walls of the hole and so strengthening them as to prevent collapse.

DRAWING OIL FROM BENEATH THE SEA



At Summerland, near Santa Barbara, Calif., even the sea is made to yield oil. For there are dozens of wells, drilled 300 feet or more into the ocean floor, producing oil as freely as if they were on dry land.

If the well proves to be a "gusher," much oil may be wasted before it is brought under control, unless careful preparations have been made in advance. But when this happens, the loss is more than balanced by the cheapness of production for some time thereafter. "Gushers" are more frequent in Mexico and Russia than in the United States. Other wells are known as "pumpers."

Wells usually decline rapidly in output soon after being opened, "gushers," for instance, becoming "pumpers." After this initial decline the output falls off more slowly until the time when it fails altogether. The Mexican "gushers," however, often show little or no decline in production or pressure up to the moment when the well without warning begins spouting hot salt water instead of oil. The practice of "shooting" a declining well by exploding a nitroglycerine torpedo in it to restore the flow is likely to be destructive and has been forbidden by many states.

The proved possibility of obtaining a good illuminant by refining petroleum was the stimulus that prompted the drilling of the first Pennsylvania well; and it is the modern improvements in refining, which, by creating a vast range of new petroleum products, have made petroleum the industrial giant that it is. The crude oil is a mixture, not a simple substance, and the first step in refining is to separate its constituents. Various processes are used, according to the composition of the crude oil and the nature of the products desired.

DRAWING OIL FROM DISTANT FIELDS

The pipes coming up out of the ground are the end of a long series of lines radiating southward and westward for hundreds of miles. They bring oil direct from the wells of Louisiana, Oklahoma, Kansas, Ohio, and Pennsylvania, into the Standard Oil Company's plant at Bayonne, N. J., the largest refinery in the world.

In the United States three main types of crude oils are recognized. "Paraffin base" oils, in which hydrocarbons of the paraffin series predominate, "flash" at the approach of a flame, and yield a high percentage of gasoline and illuminating oil. The so-called "asphalt base" oils, which are rich in hydrocarbons of the naphthene series and contain asphalt, do not ignite so readily. They yield chiefly fuel and illuminating oils, lubricants, and artificial asphalt. "Mixed base" oils vary in all proportions between the paraffin base and the asphalt base crudes.

"Fractional distillation" is based on the fact that each component of the crude oil has its own vaporizing point (*see* Distillation). The light naphthas or gasoline constituents vaporize at a temperature which scarcely scalds the skin. If the oil is kept at this constant temperature until all the naphthas have been vaporized, the gasoline vapors can be condensed separately. Then the temperature can be raised to the kerosene "boiling point" and held there until the kerosene fraction has been driven off and condensed, after which the heavier fractions are separated. These roughly separated fractions still consist of mixtures, which are still further separated, and the products are put through purifying processes.

The naphtha fraction yields aviation gasoline and other light naphthas, intermediate naphtha (which is the ordinary gasoline used in automobiles), and heavy naphtha (the "benzine" used in cleaning and in making paints and varnishes). The next fractions give, respectively, illuminating oil and "gas oil," used in making illuminating gas. The last and heaviest fraction gives paraffin wax and various lubricants. Asphalt base oils yield fuel oils, used in firing steamships, and "artificial asphalt," used for pavings. Vaseline and liquid petrolatum are among the hundred or more minor products of distillation.

The "cracking" process makes light naphthas and other hydrocarbons out of the heavy oils by literally splitting the molecules of the latter. The heavier the oil, the more complex are the molecules of which it is composed—that is, the larger is the number of hydrogen and carbon atoms in each molecule. If a heavy oil—one with 18 carbon and 38 hydrogen atoms in each molecule, for instance—is heated above the "boiling point" at high pressure and the condensed distillate is allowed to fall back into the superheated liquid, some very complex reactions take place. The upshot is the splitting of the complex molecule of the heavy oil into the simpler molecules of two lighter oils. with a carbon residue in the form of coke. The principle of the process was discovered by accident, but chemists have perfected some very ingenious methods based on it.

"Casing-head gasoline" recovered from the natural gas associated with petroleum (called "wet" or "casing-head" gas to distinguish it from the "dry" gas not associated with oil) has likewise become an important factor in the gasoline situation. "Casing-head gas" contains a large proportion of light naphtha vapors. These are recovered by either the condensation method (compressing or cooling or both) or the absorption method; the gas being passed through an oil which absorbs the gasoline.

The Power of the Pipe Lines

Transportation is the backbone of the oil industry. The Standard Oil Company rose to power, not through control of production, but through control of refining and transportation facilities. Its first decisive advantage over competitors was secured through preferential rebates from railroads; but the free gift of a railroad would scarcely have been so valuable as the pipe-line system which the Standard helped to develop and came later to dominate.

Today crude oil is transported through pipes from Louisiana, Texas, Oklahoma, Kansas, Kentucky, and intermediate states to Chicago, New York, and other refining centers. From the operator's "field tank" it is pumped to the "tank farm," a battery of huge steel tanks of 55,000 to 80,000 barrels' capacity, stationed on the pipe line route to care for surplus oil when it is produced faster than the pipes can carry it. Thence it passes into the pipes by which it is transported to the refineries. These pipes are from 2 to 8 inches in diameter, in the field lines where the oil starts, and from 6 to 12 inches in the main trunk lines. Gravity and pumps are both used. Pumping stations are ordinarily from 25 to 40 miles apart. The pipe line is much cheaper and more satisfactory than tank cars and it has almost entirely superseded other methods of land transportation in all parts of the world where oil is being produced by modern methods; but the pipe lines of the United States are still unparalleled in extent.

Refined oil is generally distributed by tank railroad cars and tank motor trucks, though there is a pipe line which carries refined oil from Pennsylvania to New York City.

The refined oil is shipped abroad in great steel tank steamers, built for the trade and owned by the oil companies. Not only does it save space and labor to use the vessel itself as an oil-container, but the risks of fire are diminished because of the decrease in waste spaces where vapors can accumulate and in surfaces from which leakage and evaporation can take place. A large modern tanker may be more than 500 feet long and carry more than 4,500,000 gallons. Owing to the speed with which oil cargoes are loaded and unloaded, by pumps and gravity, no other ships spend so little time in port.

The Greatest Producer and Consumer

After making petroleum a world industry, the United States became the world's greatest consumer and producer, producing more than half the oil used in the world between 1860 and 1918. At first practically all the oil produced came from Pennsylvania. With the gradual exhaustion of the Pennsylvania supply, and the growing demand for petroleum products, the Appalachian field was extended northward, southward, and westward into New York, Ohio, West Virginia, Kentucky, and Tennessee. New fields, some of even greater importance, have also been opened up in the West. At present the greatest production is from the Mid-Continent (Oklahoma-Kansas, central and north Texas, and northern Louisiana), California and Gulf Coast (Texas and Louisiana) fields, with important contributions from the Rocky Mountain field (Colorado, Wyoming, Montana, and Utah), Illinois and the Lima (western Ohio)-Indiana field. At different times after Pennsylvania's decline, Oklahoma and California have held first place as oil-producing states. The Appalachian field produces chiefly paraffin base oils; the California and Gulf Coast fields chiefly asphalt base; and a wide variety of asphalt, paraffin, and mixed base oils are scattered over the other fields.

On the North American continent outside of the United States, oil is found in Canada (provinces of Ontario and Alberta); on the Alaskan coast; in Mexico, which inside of two decades has shot up to third and second place in the world's production; and is being sought in Panama, Costa Rica, and elsewhere in Central America. South American oil resources are largely unexplored and undeveloped, though outside companies are seeking to develop concessions in Venezuela, Colombia, Bolivia, and elsewhere. Peru, Trinidad, and Argentina produce considerable crude oil. In Europe the most important oil fields at present known are those of Galicia, Rumania, and the Baku region, which, before the World War, made Russia the most important producing nation after the United States. Asia has the valuable fields of Persia, Mesopotamia, Burma, Borneo, Sumatra, and Japan. China and other largely unsurveyed Asiatic regions probably have oil reserves. Australia's possibilities are little known; so are those of Africa, though there are producing fields in Egypt.

The World-Wide Struggle for Oil

When petroleum was first put on the market, lamp-oil was the chief and most valuable product. The naphthas were regarded as dangerous impurities and troublesome waste products. But when the automobile industry came into existence, it quickly used up all the gasoline in sight and called for more. Producers and inventors have been busy ever since trying to satisfy this insatiable appetite.

Likewise the navies of the world have found that oil is a better fuel in many ways than coal, and are building oil-burning ships. So also are many civilian shipping interests. Between the two another heavy demand is made upon the oil resources of the world, already taxed by the demands of the automobiles and other gasoline-driven machinery.

As a result of these various demands the United States' consumption of petroleum now exceeds its production. Moreover, 40 per cent of the nation's estimated underground supply has been exhausted, while the demand is constantly increasing. From the world-wide need of developing new supplies has arisen a keen struggle, both between companies and nations, to control petroleum fields wherever they may be discovered, particularly in weak or backward countries. Some of the diplomatic moves made during the Versailles Peace Conference at the end of the World War had the control of oil resources as their motive. Mexico is of international importance partly because of its oil resources. Undoubtedly the struggle for oil resources will play a conspicuous part in world history during the next 50 years.

What will future generations do when the globe's available oil supply in liquid form is exhausted? Probably the first thing will be to develop the possibilities of the world's oil shales by crushing and distilling them for their oil.

HOW *to* BE GOOD *to* YOUR PETS

Perhaps You are Treating Them Cruelly through Ignorance of what is Best—"Do's" and "Don'ts" in the Care of Cats and Dogs, Goats, Rabbits, Canaries, and Other Tame Guests of the Animal World

Pets and Their Care. A well-cared-for pet is a source of constant pleasure to one who loves animals. Gentleness and kindness are the two means of winning the love and confidence of any pet, and there is a heart-satisfying happiness which comes from feeling that some dependent creature looks upon you as the kindest being in the whole world.

But only too often pets suffer cruelly through the negligence of even loving masters. The following rules should be followed strictly in caring for any pet: (1) it should be fed regularly; (2) its living quarters should be kept clean and sanitary; (3) it should have constant access to fresh water; (4) with the exception of cats and dogs, pets should be handled only when necessary or after they have gained enough confidence to invite caresses; (5) the habits of the pet should be studied and it should be given its natural surroundings as nearly as possible and its individual tastes should be studied and gratified.

There are at least 50 different kinds of animals and birds that are more or less commonly used as pets. Of these we have space for the discussion of only a few.

Dogs.—To understand the dog of whatever breed, we should know something of the habits of its wolflike wild ancestors. Like the wolves, dogs run down their prey by following scent and sometimes hunt in packs. Their powers of smelling are keen far beyond any of the senses of human beings.

Each breed has its own peculiarities, but in general the dog should be cared for as follows: If he sleeps in the stable or some part of the house, see that his bed is kept dry and clean and free from fleas. Straw often changed, or a piece of carpet frequently washed, will do for a bed. If a kennel is used, it should be well ventilated and built so that it can be cleaned and aired when not in use. The walls should be whitewashed or painted with creolin.

The dog should always have access to plenty of fresh clean water. Most dogs are overfed. Two meals a day, a light breakfast and supper, are enough. The diet should be varied. Meat, cooked, may be given in small quantities; cooked vegetables should be given at least twice a week. For breakfast give porridge with milk, and a dog biscuit three or four times a week if necessary. The food does not need to be warm, and should not be hot or sloppy. For the evening meal, give a mixture of vegetables and cooked meat, one-fourth or less of meat to three-fourths of bread or vegetables. The dog should have bones to gnaw, but never the bones of game or chicken. The drinking dish should be washed every day. The dog should never be fed at the table or at any but regular hours.

The dog has a very sensitive skin and should be washed only when necessary. The water for the bath should be tepid and the head wet first; no water should be allowed to get into the ears. For constipation give olive oil or small doses of castor oil; for wounds apply flowers of sulphur and crude petroleum mixed to the consistency of thick cream.

Cats. — Puss has been a household pet for so many centuries that we do not know about her wild ancestors. She has been of the greatest use in ridding houses of rats and mice. In Dick Whittington's time a cat was worth its weight in gold. The cat should have a special sleeping place in a box or basket, with a soft bed which should be changed or cleaned often. If she is confined to the house, a shallow tin of dry earth or ashes should also be kept for her use and emptied daily.

Puss should be fed at regular periods. She is fond of bread and milk and may be given potatoes with meat scraps and gravy occasionally; cooked meat in reasonable quantity should be given every day. She should have access to grass, mint, or catnip; the latter may be gathered and kept for winter use. She should always have access to a dish of clean water.

Short-haired cats do not need to be bathed, but those with long hair need frequent baths. To keep the cat free from fleas wet the fur in a mixture of two tablespoons of creolin in one quart of water, or a lather of tar soap or special flea soap.

"Kitty, Stop Eyeing that Bird!"

Train kittens when they are young to be neat in their habits and to leave birds alone. They should be punished every time they notice a bird. Cats should not be allowed out of doors at night, for they do the most harm to birds in the early morning.

Goats. — The goat is one of the most useful animals in the world. Its ancestors lived in high mountains; therefore it is a successful climber and has learned to forage upon anything it can find. There are many famous breeds of milch goats; the Angoras and Cashmeres have been bred for their fine fleece. The pet goat should have a warm light stable for winter, with plenty of dry bedding; and the place should be cleaned often. The goat must have plenty of fresh air and exercise to keep healthy. Its winter food should be corn fodder, cowpeas, clover hay, or alfalfa, with oats, corn, and bran. It likes plenty of salt and must all the time have access to fresh water. If housed in winter, it should be given twigs of hazel or maple to browse upon for entertainment. The goat should never be teased. An Angora should be washed twice a month during the summer.

Rabbits and Hares. — There are no native species of rabbits in North America, but there are hares which we call rabbits. The chief difference between the two is in habits; the rabbit is a burrowing animal, while the hare lives in a "form," a nest on the surface of the ground where the grass is beaten down or eaten out to afford a space of convenient size. Several well-marked breeds of rabbits have been developed in Europe and Asia, such as the lop-eared, Angora, Himalayan, Dutch, silver-gray, Flemish, Polish, and Japanese. The Belgian hare is well known in the United States. The common cotton-tail and jack-rabbit are hares.

The Shelter from Rain and Wind

Pet rabbits should be kept in boxes or hutches so built as to protect them from rain and cold. The hutch should be well ventilated and easily cleaned. A hutch for one rabbit should be at least three feet long and a foot and a half wide and high. The ends must be draft proof and the floor raised above the ground. A sleeping apartment should be partitioned off at one end; the hutch should be bedded down with sawdust and the sleeping apartment furnished with clean fresh straw or hay. If possible, the rabbit should have an outdoor run made of fine-meshed wire netting set at least two feet down into the ground to prevent him from burrowing out.

Rabbits and hares are vegetarians. Their chief food should be hay, clover, oats, and bran; and green food, such as grass, clover, cabbage, and roots, especially carrots. The oats, bran, or meal should be dampened but not sloppy. Food should be given in vessels that have edges turned inward so that it cannot be scratched out. These pans must be kept clean. Water should be given in a vessel fastened to avoid spilling.

When handling a rabbit do not lift it by the ears alone; clasp the ears firmly with one hand and support the animal's weight with the other.

Guinea-Pigs or Cavies.—These animals came from South America, where there are many species, varying in size from that of a mouse to a half-grown pig. The breeds used for pets are the English, with a smooth coat; the Abyssinian, with a rough coat arranged in cowlicks or rosettes; the Angora, with smooth, soft, long hair; and the Peruvian, with long hair in rosettes. All these varieties may have one or several colors.

You Must Shelter Those Guinea-Pigs, Too

The guinea-pig should be kept in a hutch inside of a house or shed, for it cannot endure cold. An inverted box a foot square with a six-inch hole in the side makes a good nest for one guinea-pig when filled with straw or hay. These animals live exclusively on vegetable food—fresh grass, lettuce, celery leaves, beet tops, plantain, water-cress, dandelions, and parsley, with apples now and then. A constant supply of carrots insures good health. Whole or rolled oats may be given, and plenty of fresh water must be supplied. Several females and one male live together happily, but if several males are kept together they are likely to fight each other. The long-haired varieties need to have their coats brushed often.

White Rats and Mice and Fancy Mice.—In general the treatment of all these should be the same, except that rats must have a larger cage. A box with a lid and one side covered with wire screen, with a floor area of 12 by 24 for a pair of rats, and 12 by 6 for a pair of mice, will do. The box may have a slit at the bottom along one side which may be opened to clean the cage with a scraper. A movable nest-box with a lid and a hole in one side may be attached to one side of the cage or put in a corner on the floor. The cage and nest-boxes should be cleaned each week with soap and hot water and thoroughly dried before being used again. The bedding may be sawdust or layers of paper; the nest-box should have paper in fine strips or excelsior.

Rats are fed meal-worms, hard-boiled eggs, table scraps, and carrots. Mice eat canary seeds, white millet, oats, stale bread or dog biscuit soaked in skim-milk, apples, carrots, grass heads, and dandelion leaves. Neither rats nor mice should be fed sugar, salt, or cheese. They are very thirsty animals and must be provided with fresh water at all times or they may kill each other.

Dancing mice should be provided with a playhouse in the cage. This is made by taking a wooden box, without a cover, about three inches square and two inches high. Cut holes one and a half inches wide down the sides of the box opposite each other. Invert this box in the middle of the cage, and the little creatures will run in and out through the openings for hours, until they are almost exhausted.

Canaries.—The ancestors of this little cheerer of the household lived on the Canary Islands and many noted breeds have been developed from them in Europe. The canary is often treated cruelly without intention. Usually the cage is too small. It should be at least 18 inches long and high accordingly. The perches should be rounded and of different sizes, to rest the bird's feet, and should be placed so as not to interfere with its exercise; no perch should be thicker than an ordinary lead pencil. The cage should be hung where there is plenty of light, but not in a window nor in a draft nor above a gas jet. The cage should be cleaned at least every other day and fresh water for drinking given every day.

A mixture of canary grass, millet, rape, and hemp is the standard food. A little green food should be given each day. Feed chickweed, lettuce, and plantain seed stalks in summer; and sweet apple, orange, raw potato, carrot, or cabbage in the winter; dry bread soaked in milk may be given for a change. A cuttle-fish bone should be always present as an aid to digestion; it should be changed every three months. Sand should be scattered on the floor of the cage. A chance to bathe three times a week should be given. If possible the canary should be allowed to fly about the room for an hour or longer each day. During the molting season the bird should be given hard-boiled egg chopped fine with an equal amount of cracker or bread crumbs, mixed with a teaspoon of cayenne pepper, in addition to the regular diet. Almost all canaries are very fond of sugar, and small quantities of it are a desirable addition to their diet.

Parrots.—These quaint birds come from tropical lands, and so they need special care in our colder climate. They must be kept in a warm room in winter and out of the draft. The cage should be of galvanized wire, two feet high and about the same in diameter, with a flat top. It should be provided with two good perches, the upper thinner than the lower; a ring may be substituted for the upper. The door should slide up and down, closing by its own weight.

Parrots are fruit eaters naturally and may be given a mixture of hemp, sunflower seeds, unhulled rice, and cracked corn; ripe fruit, preferably bananas, oranges, cherries, and apples, should be given occasionally. Cuttle-fish bone is acceptable, and sand should be scattered on the bottom of the cage. Parrots should not be fed on fish, bread and milk, parsley, chick-weed, bones, meat, or grease. Baked peanuts may be given. Water should be supplied two or three times a day and the dish removed. Most parrots are great splashers when they bathe but the gray parrot prefers to roll in the dust. A piece of soft wood for the parrot to tear in pieces should be kept constantly in the cage. This will help to keep the bird busy and happy.

We should always show the parrot gentleness and affection and never laugh at it when trying to break it of a bad habit. In teaching it to talk, a lesson should be given in the morning and again in the evening, the teacher standing close to the cage and repeating the words very distinctly.

Pigeons.—There are about 150 breeds of pigeons, including the fancy varieties. Each has a charm and beauty of its own. The first essential in a pigeon house is that it be mouse- and rat-proof. This is often accomplished by interlining or covering the walls with wire netting. The pigeon house should face southward and have a tight roof and be well ventilated. A nesting shelf should be a foot wide, partitioned into spaces a foot in length. The holes for exit and entrance to the house should be provided with a six-inch alighting board just below, both outside and inside. The house should be kept clean and should be whitewashed with lime both inside and out. It is best for pigeons to fly freely; if this is impossible, a "fly" of chicken wire must be provided.

The best food is a good quality of red wheat, Canada peas, buckwheat, hulled oats, kafir corn, and millet; hemp or rape seed is given as a treat. Do not feed barley or rice. The grain should not be new and should be thoroughly dry. Large-kerneled corn is likely to choke the birds. If they are fed only twice a day the food should be placed in hoppers. Tender green food such as lettuce or onion-tops may be given at any time. Pigeons need plenty of salt and also gravel, or crushed oyster shells mixed with coarse sand and some charcoal. They must have access to plenty of clean water both for drinking and bathing.

Crows.—Many a boy has made a pet of this very intelligent and mischievous bird and its pranks have been a joy to the boy, and the talk of the neighborhood. A pet crow should not be confined to a cage. Clip one wing and give it the freedom of the grounds and barns. It may be fed grain and table scraps of all kinds. It particularly enjoys chopped raw meat, mice, worms, and various berries. Corn should be softened first. It should have access to plenty of clean water for drinking and bathing.

Turtles.—These armor-bearers are favorite pets, but they are rarely well treated because of ignorance of their habits. With the exception of the wood and box turtles and the tortoise, all of our common turtles can only eat their food when they are submerged beneath the surface of the water. If kept in aquariums they are driven by starvation to bite off one anothers' tails and legs. For the water and pond turtles the aquarium should contain two inches of water and a piece of wood or a stone projecting above the surface. It should be kept in a sunny window. Turtles need to be fed but once a week when in captivity. Raw fish and liver chopped fine are both acceptable food. The day after feeding, the water in the aquarium should be changed. (*See also* Aquarium; Goldfish.)

PETU'NIA. Our beautiful garden flower the petunia is a native of South America and since the 19th century has been cultivated in other countries. Through hybridizing, rich shades of crimson and rose, magnificent purples, and a number of spotted and striped varieties have been introduced. Some species, too, have deeply ruffled and fringed corollas, and some are double. The plant, except in the dwarf varieties, has a tendency to sag and sprawl about the ground with many upright flowering branches. The finest flowers are produced in deep rich soil in sunny places. They make attractive beds and borders and are also grown as hothouse and conservatory plants.

The petunias are hybrids usually of *Petunia nyctaginiflora* or *Petunia violaceae*. They belong to the same family as the nightshade (*Solanaceae*).

PHAETHON (*fā'ĕ-thŏn*). This daring and beautiful youth, whose name means "the shining one," was the son of Helios, the sun-god of the Greeks (sometimes identified with Apollo), by the nymph Clymene. In a moment of rashness Helios swore by the sacred river Styx that he would grant his son anything he asked. Phaethon asked the one thing that his father would have refused him—to be allowed to drive the chariot of the sun. God though he was, Helios dared not break his solemn promise, so Phaethon's wish was granted. He started boldly on his journey across the heavens, but very soon lost control of the fiery horses of the sun. Rushing headlong from the beaten track, they drew the sun so low that the mountain tops were scorched and finally even the trees and the grass and the grain in the fields were burnt. When Zeus saw that the whole earth was about to be destroyed, he seized one of his thunderbolts and hurled it at Phaethon, who fell like a shooting star into the river Eridanus, now called the Po. His sisters, the Heliades, who stood on the bank weeping, were turned into poplar trees, and their tears, it is said, fell into the stream and became amber.

PHEASANT (*fez'ănt*). The pheasant is a large game bird with brilliantly colored feathers, related to the partridge and grouse. The males have long showy tail coverts. Pheasants are found in greatest abundance in England, where they are supposed to have been introduced by the Romans; but they may have been native to both the British Isles and southern Europe.

THE GOLDEN PHEASANT, MONARCH OF HIS KIND

The Golden Pheasant, because of his brilliant plumage, is a favorite for parks and "zoos." His rich scarlet body, with yellow, blue, and black markings, his crest and collar of gold, barred with black, and his long bright tail, all combine to make him the most gorgeous of his tribe.

The common English pheasant (*Phasianus colchicus*) is about three feet long, including the tail, which represents half the length of the bird. The plumage is beautifully mottled brown and buff, with changeable lights of blue and green over the breasts of the males. Great numbers of these birds are reared and fed artificially, and liberated in game preserves on English estates. The practice of bringing up these birds in domestication is now extensively followed, the numbers so reared vastly exceeding those that are bred wild. Eggs are collected from birds that are either running wild or kept in pens, and are placed under domestic hens, who make good foster-mothers for the young pheasants.

"PLEASE DON'T STOP!"

The male English Pheasant seems easily alarmed, but the female will remain on her nest until the hunter is almost upon her, hoping he will pass on without noticing her. The nest is built on the ground, usually among dead leaves or branches, and the female hatches 10 to 12 eggs at a time.

The only representative of the pheasant family native to North America is the wild turkey (*see* Turkey). The first successful introduction of foreign pheasant stock into the United States was in 1880, when 22 cocks and 20 hens were liberated in the Willamette valley in Oregon. These birds were ring-necked pheasants of China, marked by a broad white collar over their grayish-blue wing coverts. In 1892 an open season resulted in a first day's shooting of 50,000 birds. These pheasants have been likewise tried in many parts of North America, but they flourish best in Oregon, Washington, and British Columbia.

Pheasants of China and India display gorgeous plumage. The golden pheasant has rich scarlet, yellow, blue, and black colorings, a golden crest, and an extremely long tail, beautifully marked. The silver pheasant has upper plumage of silver-white, with black under parts.

PHIDIAS (*fĭd'ĭ-ăs*) (about 500–430 B.C.). The greatest of all Greek sculptors, and one of the greatest in all history, was the Athenian Phidias, who alone, it was said, had seen the gods and made them visible to others. The information about his life is scanty and often contradictory; for our knowledge of his work, also, we are largely dependent on the statements of ancient writers, as no certain original of his hand has survived, although miniature copies show the designs of his greatest statues.

Phidias was born at Athens about 500 B.C. When he reached young manhood there came to him such an opportunity as comes to but few artists. He was appointed by Pericles, who had risen to the head of affairs at Athens, to superintend the adorning of that city with fine public buildings, and to execute the most splendid of the statues to be erected. It was largely through the genius of Phidias that Athens was made the most beautiful city in Greece, with more temples, colonnades, and other works of art than were constructed in seven centuries in Rome. He supervised the construction of the Parthenon, the magnificent temple of Athena on the Acropolis; and while the sculptured ornaments of this building were probably executed by his pupils, the giant statue of Athena, in ivory and gold, which stood inside the temple, was the work of Phidias himself (*see* Acropolis). His masterpiece was a colossal gold and ivory statue of Zeus for the Olympian temple in Elis, ranked for its majestic beauty among the wonders of the world.

In his later years Phidias was accused of appropriating a portion of the gold designed for the robe of Athena. He disproved the charge; but he was then charged with impiety in having placed his own likeness and that of Pericles upon the shield of the goddess, and was thrown into prison, where he died about 430 B.C.

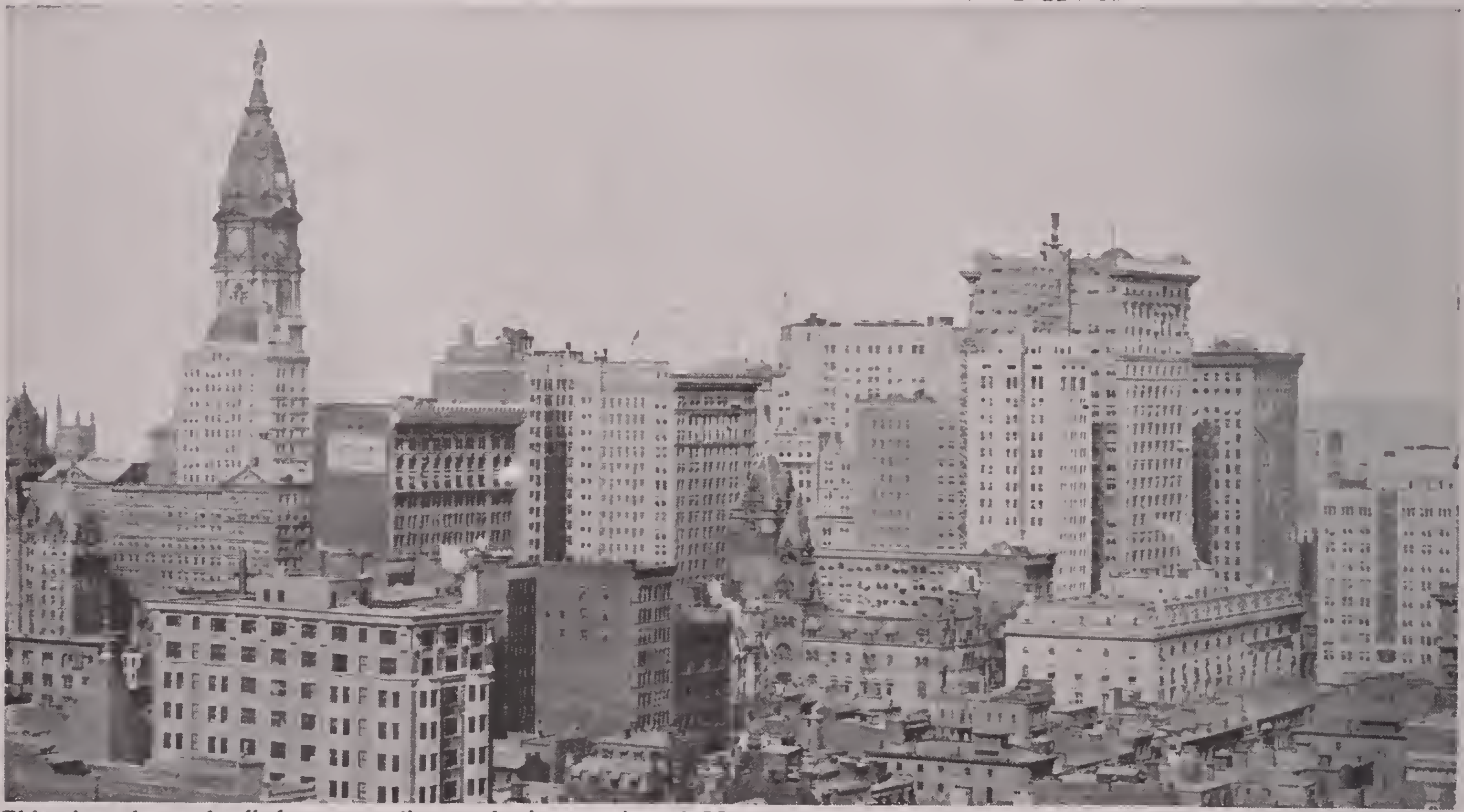
The STATELY *Old City of* WILLIAM PENN

The First Capital of the United States, where the Declaration of Independence was Signed, where the Continental Congress Sat, and where Ben Franklin Rose to Fame—The "City of Brotherly Love" as It is Today

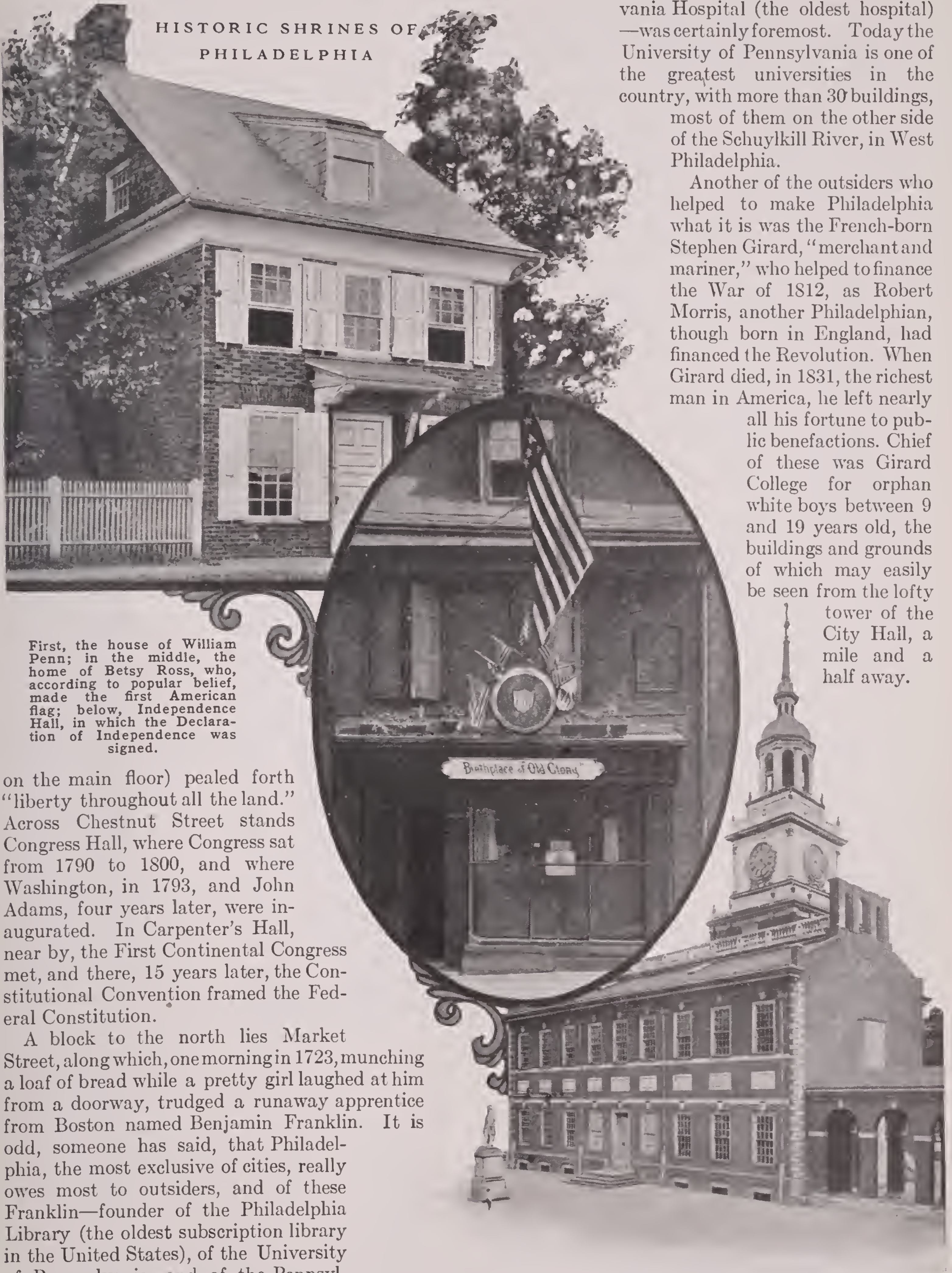
PHILADELPHIA, PA. William Penn, in his broad-brimmed Quaker hat and full-skirted Quaker coat, stands 37 feet tall, enjoying the "fruits of solitude" on City Hall tower, 548 feet above the pavements of his "dear Philadelphia." To the Schuylkill River on his left, and the Delaware on his right, runs Market Street, 110 feet wide; before him and behind runs Broad Street, 113 feet wide; and if you think the rest of the streets, except the splendid new parkways and boulevards, not remarkable for width, please remember that when Philadelphia was planned, in 1682—the first modern city with a plan prepared for its site—its 30 per cent of area allotted to street surface was unheard-of prodigality. Its "gridiron plan" of streets crossing at right angles has quite generally been followed in laying out other American cities.

Some distance behind and to the right is Independence Square, where stands America's most famous landmark—the old state house built in 1735, now Independence Hall. Here the Second and Third Continental Congresses met, here Washington was made commander-in-chief of the American armies, and here the Declaration of Independence was adopted, while the old Liberty Bell (now preserved

IN THE HEART OF PHILADELPHIA



This view shows the "skyscrapers" near the intersection of Market and Broad, the principal thoroughfares of the city. The tower to the left rises above the City Hall, which stands in the center of a group of public buildings. On its top is the massive statue of William Penn, 37 feet high and weighing 53,348 pounds.



HISTORIC SHRINES OF PHILADELPHIA

First, the house of William Penn; in the middle, the home of Betsy Ross, who, according to popular belief, made the first American flag; below, Independence Hall, in which the Declaration of Independence was signed.

on the main floor) pealed forth "liberty throughout all the land." Across Chestnut Street stands Congress Hall, where Congress sat from 1790 to 1800, and where Washington, in 1793, and John Adams, four years later, were inaugurated. In Carpenter's Hall, near by, the First Continental Congress met, and there, 15 years later, the Constitutional Convention framed the Federal Constitution.

A block to the north lies Market Street, along which, one morning in 1723, munching a loaf of bread while a pretty girl laughed at him from a doorway, trudged a runaway apprentice from Boston named Benjamin Franklin. It is odd, someone has said, that Philadelphia, the most exclusive of cities, really owes most to outsiders, and of these Franklin—founder of the Philadelphia Library (the oldest subscription library in the United States), of the University of Pennsylvania, and of the Pennsylvania Hospital (the oldest hospital)—was certainly foremost. Today the University of Pennsylvania is one of the greatest universities in the country, with more than 30 buildings, most of them on the other side of the Schuylkill River, in West Philadelphia.

Another of the outsiders who helped to make Philadelphia what it is was the French-born Stephen Girard, "merchant and mariner," who helped to finance the War of 1812, as Robert Morris, another Philadelphian, though born in England, had financed the Revolution. When Girard died, in 1831, the richest man in America, he left nearly all his fortune to public benefactions. Chief of these was Girard College for orphan white boys between 9 and 19 years old, the buildings and grounds of which may easily be seen from the lofty tower of the City Hall, a mile and a half away.

Midway between the City Hall and Girard College, on Spring Garden Street, you may see the United States Mint, probably the finest mint building in the world. Here are made two-thirds of the coins of the United States and in addition many of those issued by South American countries (*see* Mint, United States). Fairmount Park, with its 3,400 acres and its many objects of modern and historic interest, is a little beyond your range of vision as you stand at Penn's feet. Still farther to the northwest, though within the city limits, is historic Germantown, with its charming old mansions.

The "Social Heart" of the City

Rittenhouse Square, behind the City Hall and to the left, enshrines the quintessence of Philadelphia's social sanctity. Philadelphia is the "City of Brotherly Love," but it has humorously been said that it makes all the difference in the world *whose* brother you happen to be—and also where you happen to live. As well the North Pole as any place "north of Market Street," at least in the palmy days of "Chestnut, Walnut, Spruce, and Pine"—the unpretentious dignified old streets from whose sedate red-brick houses the old Philadelphia families are being slowly driven by surging alien tides.

The capital of Pennsylvania from 1685 to 1799, the seat of Federal government from 1790 to 1800, the most important city and port of the country during the 18th and early 19th centuries, the third city in the United States today in manufactures and in population, "grave, calm, kind old Philadelphia," as Thackeray called it, has always borne its honors without boasting and with seemly Quaker staidness.

Wealth and Industry

The first element in Philadelphia's greatness was its excellent harbor. This made it a commercial city even in the old "colonial" days of the China trade, the 120 miles' distance of the port from the sea being little drawback, in view of the broad and deep river highway which leads to its wharves and warehouses. In addition the good roads leading into the interior—later taking the form of the Pennsylvania and the B. & O. railroads—gave it command over a growing western trade. Today its situation as Atlantic outlet of the Pennsylvania coal fields makes it a manufacturing city as well as a great commercial port. It has the largest shipbuilding plant (at Hog Island) and the largest saw works in the world, while the Baldwin Locomotive Works produce more locomotives than any other concern in the country. One of Philadelphia's iron works bridged the Nile and the St. Lawrence rivers, the latter with the greatest cantilever span in existence. In quantity of foundry, rolling mill, and machine-shop products, in carpets, hats, street railway cars, knit goods (especially hosiery), and woolen goods, Philadelphia leads. William Penn, peering down through the smoke from his position on the City Hall, may well wonder at the change that has come over his "greene country towne." Population, about 1,825,000.

PHILIP, KINGS OF FRANCE. The name Philip was first introduced into the royal line of France in the 11th century by a French queen who was the daughter of the Russian czar and claimed descent from the great king Philip of Macedon. Her son was Philip I of France, 1060–1108, the first of six monarchs to bear that name; only three of these, however, call for our attention.

PHILIP II, 1180–1223, is best known by his title "Philip Augustus"; he was so called, according to a chronicler of the times, because "he enlarged (*augere*, "to increase") the boundaries of the state as the Emperor Augustus enlarged those of the Roman Empire." He was a contemporary of Richard the Lion-Hearted of England, and of Frederick Barbarossa of Germany; and all three went on the Third Crusade to re-capture the Holy Sepulcher from the Mohammedans under Saladin. But Philip soon took advantage of a quarrel with Richard to return home. From that time until the end of his reign he devoted his time and energy, with great success, to enlarging his kingdom and increasing his power. When he came to the throne the land over which he actually ruled was merely a small territory around Paris, while most of the present kingdom of France was held as a fief by the King of England, with whom the French ruler usually carried on continual warfare. From King John, Richard's successor, Philip succeeded in taking a great part of the continental possessions of the English kings, including Normandy, the cradle of their race. Philip II also strengthened his control over all classes of his subjects, and by encouraging the towns he lessened the influence of the powerful feudal lords. Paris now first became the regular capital of the realm, and the building of the great cathedral of Notre Dame was carried far toward completion.

One event mars the reign of this king. This was the crusade which he allowed to be waged against the Albigenses, a heretical sect in southern France. As a result of this, thousands of people were murdered and one of the fairest parts of France devastated; but it became the means of increasing the royal territory.

A Handsome and Powerful Ruler

PHILIP IV, 1285–1314, called "The Fair" because of his good looks, is the next Philip of France who deserves mention. He is the first example of a French king who had both the will and the means to become a powerful monarch, and he set a mark upon French life and government which has not been wiped out by the floods of successive revolutions. His reign was notable chiefly for the development of the royal power, the increase in taxation, the meeting of the first session of the Estates-General (a national assembly corresponding to the English Parliament) and for his struggle with and triumph over Pope Boniface VIII.

To understand this struggle we must note that Philip was engaged in war with England and with Flanders, and to carry on these wars he needed money.

After taxing laymen all he could, Philip turned to the rich churchmen for money. But the pope claimed that church property was not under the jurisdiction of the state and could not be taxed, and he forbade the priests to pay the taxes levied by Philip. In the end the king not only won the conflict with the church, but he also secured the removal of the popes from Rome to the southern border of France, where they were more easily subjected to French influence. This was the period of the "Babylonian Captivity" of the church which lasted for 70 years (*see* Boniface).

Philip VI, 1328–1350, was not personally of especial importance, but his accession to the throne calls for mention because of momentous consequences for both France and England. In 1328 the last Capetian king of France, Charles IV, had died without a son, and there arose the question of succession to the throne. It was decided, following a precedent set in 1314, that a woman could not rule over France, and the new principle was now added that she could not hand on her claim to a son. The throne, therefore, went to Philip of Valois, the nearest descendant in the male line, who became Philip VI of France. His chief rival was young Edward III of England, whose mother was the sister of Charles IV. At first this decision was accepted by all, but in 1337 Edward III of England denied the justice of it, and laid claim to the throne of France on the ground that he stood nearer in relationship to the last preceding king than Philip of Valois. This claim was one of the grounds for the Hundred Years' War, which was waged, except for brief intervals, until 1456, and which ended by England losing all her possessions in France except Calais. It was this, in fact, which led her to turn her attention to the seas, where she soon reigned supreme. The war also helped the king of France to consolidate his power into the absolutism which existed until 1789.

THE KING WHO LOST SPAIN'S POWER

Philip II had far reaching ambitions which brought him into conflict with leaders greater than himself. He suffered reverse after reverse at the hands of Elizabeth of England, Henry of Navarre, and William of Orange, and Spain's power was permanently broken.

PHILIP, KINGS OF SPAIN. At the end of the reign of each of the Philips of Spain the country was a little weaker politically, a little poorer industrially, than it was when he began to rule. The first, third, and fourth of the name were so characterless that they have left no trace of their personality. Philip V, also,—the first of the French or Bourbon kings—was "distinguished for few faults and few virtues"; but the weak-minded man acquires importance from the devastating War of the Spanish Succession (1700–1713) by which he gained his throne (*see* Louis, Kings of France).

Philip II in 1556 took up the burden of ruling Spain when his father Charles V laid it down, and he continued to carry it until his death in 1598. His kingdom included Spain, the Netherlands, parts of Italy, and the Spanish possessions in the New World, the other possessions of Charles V going to Charles' brother Ferdinand, head of the Austrian Hapsburgs. Is it any wonder that he failed to rule well such scattered dominions?

He was 28 years of age when his father abdicated, but he was prudent and experienced beyond his years. Dull and plodding, he was determined to do his best and to sacrifice everything to his view of duty. Unfortunately, though he was conscientious and well-meaning, he believed that his mission in life was to win world-wide power for Spain and the Roman Catholic church. His first wife, Queen Mary the Catholic of England, died two years after he became king, and he had small chance to win England for Spain after that with Queen Elizabeth as his rival. He was no match for her in international intrigue, and even his effort to conquer England by force was a failure, for the expedition of the Invincible Armada in 1588 ended in disaster (*see* Armada, Spanish).

This defeat alone would not have wrecked Spain, but Philip's policy had weakened the country in other ways. His intrigues in France against the Huguenots and in behalf of the Catholic League were frustrated by the victories which brought the Protestant bred Henry of Navarre (Henry IV) to that throne (*see* Henry, Kings of France). In his desire to extend the power of the church he had also encouraged the activities of the Spanish Inquisition. He drove from Spain the Moriscoes, the thriftiest people in the kingdom (*see* Moors). And his efforts to stamp out Protestantism in the Netherlands by the same means led in 1568 to a revolt under William of Orange, and to the final independence of the Dutch Netherlands or Holland (*see* Netherlands, Kingdom of; William, Prince of Orange).

The GARDEN ISLES *of the* CHINA SEA

Extent.—Extreme length of archipelago, north to south, about 1,100 miles; east to west, nearly 700 miles. Total area, 115,026 square miles, of which about two-thirds is contained in Luzon and Mindanao. Population (1920 census), 10,350,000.

Natural Features.—About 3,140 islands, largely of volcanic formation, traversed from north to south by irregular mountain chains. Highest peak, Apo Volcano (on Mindanao), 10,311 feet. Moist tropical climate, with frequent hurricanes and earthquakes.

Principal Products.—Corn, rice, Manila hemp, sugar cane, coconuts and copra, tobacco, coffee, cacao; manufactures of cigars and cigarettes, and coconut oil; lumber, fish, cattle; some gold and other minerals.

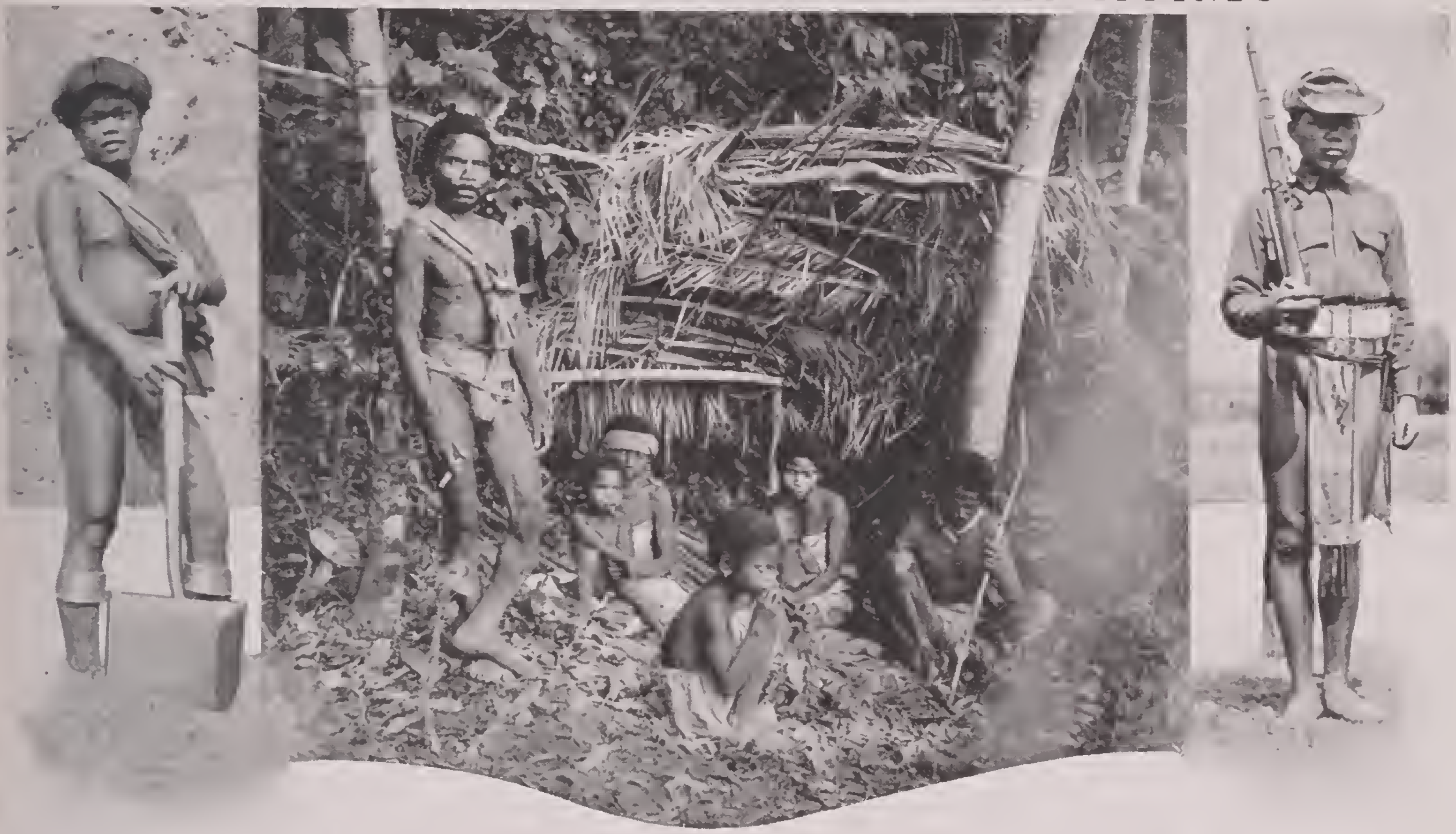
Chief Cities.—Manila (capital), about 285,000; Baguio ("summer capital"), in mountains of Luzon; Iloilo, Panay, Cebu, Laoag, Albay, about 50,000.

PHILIPPINE (*fĭl′ĭ-pĭn*) **ISLANDS.** Directly east of the Indo-Chinese peninsula and north of the East Indies and Australia are the Philippine Islands, so far away from their guardian, the United States, that when it is 12 o'clock noon in New York City it is 1:03 a.m. "tomorrow" in Manila. They lie wholly within the tropics, so that if they could be brought straight across the Pacific to the American continents they would extend from the middle of Mexico to the middle of Colombia, South America. Populated almost entirely by people of the colored races, these distant tropic islands seem strange wards for America; and indeed the United States is only waiting for the Filipinos to become capable of self-government before granting them independence. In the meantime it is continuing its work of education and sanitation begun in 1899 at the close of the Spanish-American War, when it acquired the islands by conquest and purchase from Spain.

Scattered in haphazard fashion between the China Sea and the Pacific Ocean, the 3,140 islands of the Philippines form an archipelago almost as large as that of Japan proper. Luzon, the farthest north of the large islands, is equal in area to Ohio; and Mindanao, in the extreme south, is as large as Indiana. Between Luzon and Mindanao are eight other islands of considerable importance, while to the southwest is the long narrow island of Palawan. Hundreds, however, are so small that they are mere specks on the ocean, inhabited only by sea birds. All but 367 out of the 3,140 islands occupy areas of less than one square mile apiece.

On all the larger islands the scenery is made beautiful by high mountain ranges and by the diversity and abundance of the tropical vegetation. The Philippines have no deserts, nor even barren lava beds. More than half of the entire surface is covered with forests, many of which, in the mountainous interiors, are inhabited by savages and have never been fully explored. There are about 50 volcanoes scattered about the archipelago, some of which are still active. Of these the most beautiful is Mayon, in southern Luzon, a perfect cone rising to a height of almost 9,000 feet, its lofty crater perpetually enveloped in a great cloud of vapor; and the most remarkable is Taal, situated in the midst of a lake near Manila, which has a crater containing several lakes of many-colored boiling liquids. In the last three centuries Mayon has had several eruptions of great violence, and in 1911 Taal poured forth a flood

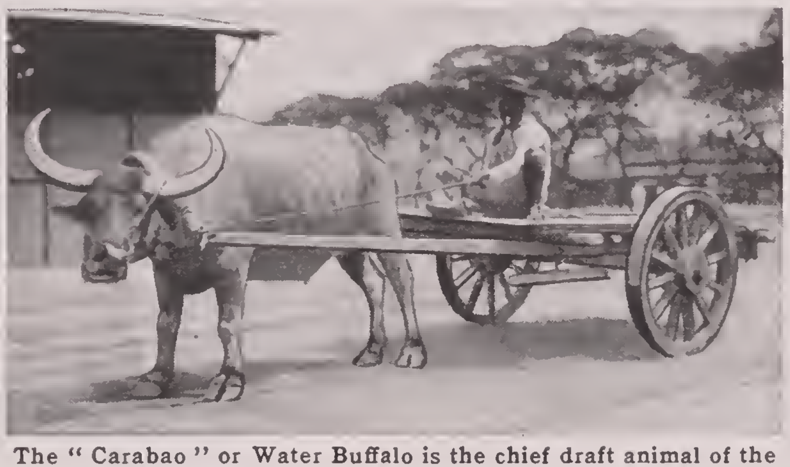
CIVILIZATION AND DRESS IN THE PHILIPPINES



These pictures show the contrast between the Filipino in his native wilds and the Filipino after he has been touched by the hand of civilization. The ancestors of the savage on the left used to find their chief delight in cutting off the heads of their enemies and preserving these heads as evidence of their prowess. Now the young "head-hunter" is helping to build good roads through his tribal forests. On the right is a Filipino policeman, with as much uniform as he can stand. In the middle we see a family of negritos —the real wild men of the islands.

of fire and ashes which took more than 1,300 lives. Slight earthquake shocks are so frequent in most of the islands that they scarcely arouse comment. There is an average of more than 100 such disturbances in Manila each year. Yet volcanic forces destroy little compared to what they have given; for it was chiefly by their means that the islands were raised above the sea.

THE FILIPINO'S "AUTO"

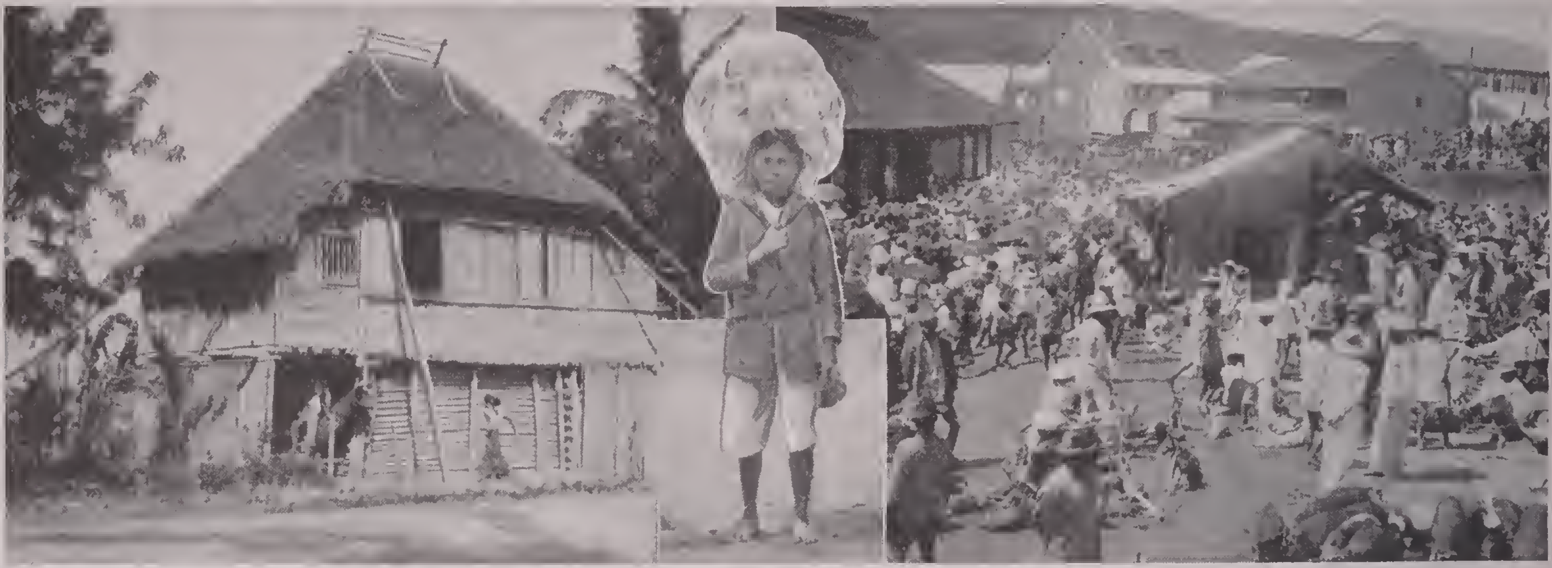


The "Carabao" or Water Buffalo is the chief draft animal of the Philippines. He is guided by having his nose pulled about like that.

Summer and winter are much alike in the Philippines; it is always warm, except on the high mountain tops. The surrounding ocean makes the climate equable, Manila (the capital) having an average variation of only 5° between winter and summer temperatures. The Spanish described the weather briefly as "six months of dust and six months of mud," but these seasons do not coincide throughout the archipelago. When it is very wet in one place it is dry in another, so that one could move about so as to escape the rains altogether. From June to November the southwest monsoon waters only the west side of the mountains, while from November to June the monsoon blows in the opposite direction, making the east side rainy. During the rainy season the much-dreaded typhoon or "baguio" does its deadly work. Hour after hour the rain descends in sheets, driven almost horizontally before a furious gale, overturning small houses and sending insecure roofs and shutters sailing away. As many as 2,000 people have been lost in one of these storms.

Probably in no other part of the world are there so many distinct peoples on a small area as in the Philippines, where even the small islands have many districts isolated by high mountains and jungle growth. The original inhabitants were pigmy blacks, the Negritos or "Little Negroes," one of the most diminutive peoples in the world. Like the African negro they have crispy hair and wide noses, but they rarely attain a stature of five feet, and seldom live to be 50 years old. For the most part the 30,000 Negritos are still true savages, building no houses, and depending chiefly on the game they kill with their bows and arrows. Being of a timid disposition, these tiny black men keep to the deep forests, where they were driven by the Malays, and give little trouble. The Igorots

HOMES AND HABITS OF THE FILIPINOS



If you were a Filipino on the Island of Cebu, you would live in a house like that. The upper story projects over the lower, and the outer walls are mostly sliding frames. The native in the center is carrying a load of hemp on his head. This is a common form of transportation. On the right is one of the public markets of the islands, where the people go to buy dogs. No, they do not usually keep them as pets—they eat them!

and allied tribes are a much more numerous savage people, who keep to the mountains as persistently as the Negritos to the forests. They are found chiefly in central Luzon, where they till the steep hillsides by a laborious method of terracing. They are strong and enterprising, of medium stature, with mixed Chinese and Malay blood. A few of the more warlike tribes still take the heads of their enemies in tribal feuds as they did when Spanish occupation began; but the friendship which has grown up between them and the Americans is tending to make the majority peaceful and satisfied. Hundreds of Igorot children are now in the public schools.

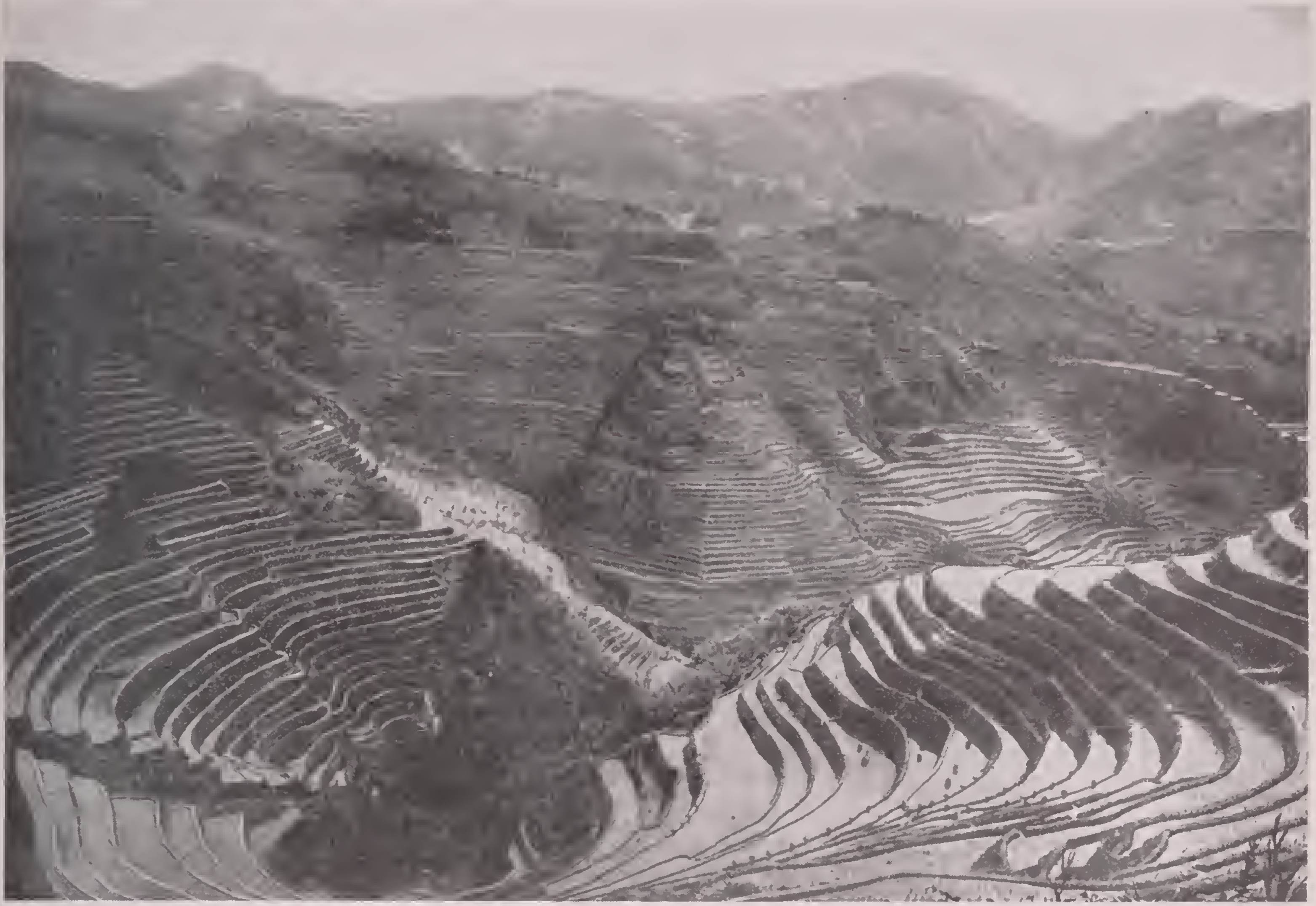
MRS. IGOROT IN HER RICE FIELD

Rice is the staple food of nearly all the islanders. It is grown in water-covered fields. This woman is typical of the Igorot people.

The most formidable people with whom the Spaniards and Americans had to deal were the Moros, a Malayan race with a religion of degraded Mohammedanism. They number about 700,000. Though driven out of the northern islands by the Spaniards, they still hold practically all of the large and fertile island of Mindanao, and the Sulu (or Jolo) Islands southwest of it. Like all Mohammedan warriors, they were taught to believe that special rewards awaited him who died fighting the "infidel," and were almost irresistible with their sharp-knived weapons. They received their first serious defeats in 1902–03 when Capt. John Joseph Pershing led troops against them in Mindanao, and Gen. Leonard Wood quelled an uprising in the Sulu Islands. Under the United States' administration, persistent efforts are being made to stamp out slavery, polygamy, and the freebooting raids which have made their name a terror to their neighbors.

The seven great tribes in the Philippines who have been christianized are known as the Filipinos—a small slender race with brownish-yellow skin, narrow black eyes, and heavy straight black hair. It is almost certain that these people came to the islands some time after the arrival of the Igorots and other pagan tribes and forced back those less cultured peoples to the mountains. They had a written language when the Spanish found them, and other elements of civilization; and it was consequently with the Filipinos that the missionaries of Spain and America have been chiefly concerned. From the intermarriage of Filipinos with Spaniards has sprung another type, called *mestizos*, a numerous and powerful class whose influence is strongly felt in political and industrial affairs. The admixture of Chinese blood has also profoundly modified the early Filipino type, for the rich Philippine Islands attracted Chinese from very early times.

THE TERRACED RICE LANDS OF THE MOUNTAIN REGIONS



At first glance, you might think this the ruins of some gigantic amphitheater, but in reality it is a striking view of the terraced rice lands in the mountainous regions of the Philippines. These protecting walls are built, one above another, to retain the water and hold the precious soil in place so it will not be washed away by the tropical rains.

There are Chinese shopkeepers, brokers, and petty dealers in all parts of the islands, though nearly half of them reside permanently in Manila. In spite of their industry, or perhaps because of it, they have always been an unwelcome race and have occasionally been massacred. Spain and America have both prohibited their coming to the islands, and they number less than one per cent of the total population. Nevertheless they control three-fourths of the retail trade and commerce.

The Spaniards christianized the Filipinos—a remarkable missionary achievement—but there they stopped. In the three centuries of their occupation they did practically nothing in the way of public improvements and education. They discouraged the teaching of Spanish, leaving the people unable to communicate with those outside their own tribes, and they built few roads. When Americans entered Manila they found it one of the foulest places in the East. Pure drinking water did not exist, even outside the capital. Lepers were left free to go where they would, and great scourges of smallpox, cholera, and bubonic plague came and spread until they died out of themselves, for there was no medical knowledge to check them. Into this disease-ridden country the Americans brought a constructive program that would have been stupendous even in the United States, but was greatly complicated in the Philippines by the ignorance of the people. The superstitious natives attributed diseases to evil spirits, and refused to believe that boiling water before drinking it would prevent much sickness. But slowly the health authorities won their fight for pure water, and by that means alone cut the death rate in half in many provinces. Hundreds of artesian wells have been drilled. A start has also been made in fighting tuberculosis, with which it is estimated one-third of all Filipinos are infected; and in combating animal parasites, which are largely responsible for their poor physical condition and inertia.

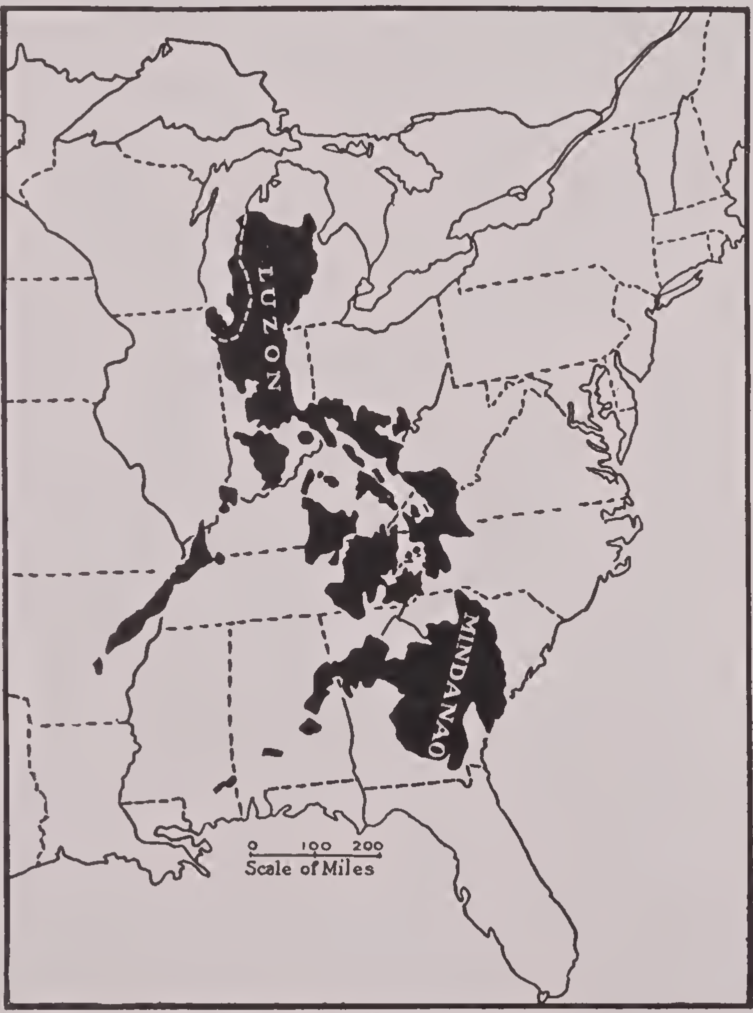
With the campaign for health has gone one for education. Even before civil government was established, American volunteer soldiers went into the schoolrooms and taught, while the hostile parents of the children lurked in the background. Soon a thousand American teachers were brought over, and a school system was begun much like that in the United States; while thousands of Filipino young men and women were sent to attend colleges and universities in the United States. But the futility of teaching history and geography to children who could not even handle a hammer soon became evi-

IN MANILA'S CHIEF BUSINESS DISTRICT

That big building you see is a Masonic temple, which has been erected in recent years. The other buildings are better examples of Filipino city architecture. Because of the frequency of earthquakes, these structures are low, and, for the same reason, it is not the custom to plaster them.

dent, and now industrial training has largely replaced the old curriculum. Basket-making, weaving, carpentry, and agriculture are now being emphasized, as well as athletics; and today one will see as many baseball games in progress in Manila as in any American city of the same size. English is used in the schools, and more Filipinos can now speak it than any other language or dialect. A striking indication of the educational progress that has been made is that thousands of natives have received degrees from the University of the Philippines, established in 1908 at Manila.

Improved methods of agriculture, which the Bureau of Agriculture and the schools are trying to bring about, will accomplish wonders in adding to the wealth of the islands. The soil of the Philippines is very fertile, producing astonishingly heavy crops year after year. For a number of years the Bureau has been carrying on experiments in methods of planting and possibilities of new crops, improving the breed of farm animals, checking rinderpest (a contagious fever) and other cattle plagues, and introducing fruits from nearby countries. Although the Philippines have many varieties of fruit, nearly all of it is wild and poor in quality. The chief domestic animals are the water buffalo or carabao, used both as a draft animal and for food, and the pig.



This composite map gives you an idea of the relative size of the Philippine Islands, as compared with the eastern half of the United States.

The principal crop for which the Philippines are known is the so-called Manila hemp, which is properly speaking not

WHAT THE SCHOOLS DO FOR THE FILIPINOS

Of course that Filipino boy enjoys manual training—all boys do. Manual training is a required subject in all government schools in the Philippines, and there are over 800,000 children in these schools. The girls playing the guitars are Igorots, and are much more backward in their development than the girls of the city of Manila, looking at us from the lower picture. To the right of them, a high-school boy is working in a school garden.

hemp at all, but the fiber of a wild plantain, called the "abaca," a tree which resembles the banana. This tree grows nowhere else in the world except on a few plantations in Borneo, and even on the islands its cultivation is limited to a few regions. With the expenditure of but a small amount of labor and care, thousands of tons of this valuable fiber are produced annually and exported either raw or in the form of rope and cordage. Tobacco is another characteristic product, in quality among the best in the world. As practically all Filipinos are smokers—men, women, and children—the home consumption of tobacco is very large; yet more than 300,000,000 cigars are exported annually. Sugar is another important staple, which is raised chiefly in the central islands. There are about 45,000,000 coconut palms on the Philippines, and more copra (the dried meat of the coconut) is produced here than in any other country. The principal foods of the Filipinos are rice and fish; and though they do not raise enough rice to supply their own needs, it is the most valuable of the crops. Corn, coffee, cacao beans, and indigo are other agricultural products.

Resources that Await Development

With more than half of its area covered by forests which contain hundreds of varieties of hardwood trees, lumbering promises to be an important industry in the Philippines. It is so little developed at present, however, that even the wood for cigar boxes is imported, owing to the lack of roads in the interior of the islands and adequate shipping facilities and the scarcity of reliable labor. Since American occupation, about 1,000 miles of railways have been built (chiefly on Luzon) and several thousand miles of roads, but much more construction is necessary for the profitable development of the island's resources. The bamboo supplies most of the construction needs of the natives, who make both houses and furniture of it. Mineral resources are also as yet undeveloped, although there are some successfully operated gold mines, and copper, iron, and coal are said to exist in large amounts. With the exception of cigars and cigarettes, most of the industries of the islands are carried on in the home. Some of the finest embroidery in the world is produced by the Filipinos, who also make hats, mats, baskets, lace, and beautiful hand-woven cloth.

The Philippines were discovered by Ferdinand Magellan, who entered Cebu harbor in April 1521. During a skirmish with the natives he was killed, but his ships went on and made the first journey around the world. In 1542 Ruy Lopez de Villabos attempted to conquer the islands, and named them "Filipinas" in honor of Prince Philip of Spain. In 1564 Miguel Lopez de Legaspi arrived from Mexico with 400 men in addition to a group of friars, and founded the first permanent Spanish settlement on the island of Cebu. Before his death in 1572 he completed the conquest of the islands and explored a large part of the territory. Spain was interested chiefly in christianizing the islands, and the religious motive dominated them for more than three centuries. After the revolt of South America and Mexico from Spain, however, the Philippines became Spain's richest possession, and the spirit of colonial exploitation grew. In 1896 the Filipinos, led by Emilio Aguinaldo, revolted.

In 1898 the United States went to war with Spain (*see* Spanish-American War); and on May 1 Commodore Dewey arrived in Manila Bay and totally disabled the Spanish fleet (*see* Dewey, George). On the 13th of August American forces occupied the city; and the Philippine Islands passed formally into the hands of the United States on April 11, 1899, by the treaty of peace and a payment of $20,000,000. Aguinaldo's army, which had been fighting the Spaniards, now attacked the Americans. There followed hundreds of engagements before the islands were finally subjugated, ending with the capture of Aguinaldo in 1901. Civil government was then established, with William Howard Taft as governor-general. In addition to their governor-general, appointed by the president of the United States and confirmed by the Senate, the Philippines are governed by a legislative body composed of a Senate and a House of Representatives elected by the people. The central, provincial, and local governments are now largely in the hands of natives, with excellent results. In 1916 the American Congress passed the Jones Bill, promising the Philippines independence after a stable government was assured.

PHILIS'TINES. When the Israelites entered the Promised Land, among the tribes which they found there were the Philistines, who proved to be their greatest enemy. They were the strongest of the Canaanite tribes, and acquired so much power and influence that the whole country became known as Palestine, or the land of the Philistines. Their group of five cities—Gaza, Ashkelon (Ascalon), Ashdod, Gath, and Ekron—formed a small district on the coast of the Mediterranean, southwest of Israel. It is thought that they were of the Mediterranean race and came originally from Crete. Their religion was an idolatrous worship centering about Dagon, a god represented as part man, part fish. Like the Semitic Phoenicians, to the north of Israel, they were a seafaring people; but while the Phoenicians confined themselves to peaceful pursuits, the Philistines continually harassed the Israelites and sought by conquest to extend their territory to the east. They finally fell before the great conquerors who one after another swept Palestine—the Assyrians, Babylonians, Persians, Ptolemies of Egypt, Seleucids, and the Romans. The name "Philistine" is today used as a term of contempt for narrow-minded persons.

The LONG *and* VARIED HISTORY *of* WORDS

How Words, Like People, are Born, Grow Old, and Die—Some Change Their Occupations and Any of Them are Likely to Have Queer Relations

PHILOLOGY (*fĭ-lŏl′ō-ġy*). Language grows much as a tree grows—the big simple things first, like the roots of the tree; then more complicated things that reach up like the trunk and the branches; and next the thousands on thousands of little separate words, each like the others and yet different, like the leaves. It has been found that all languages obey much the same general laws, and the study of different tongues and their relationships is called "philology"—from Greek words meaning "the love of the word."

Language is still growing, growing and changing all the time, though you may not notice it. New words are being added and old words dying, and some words are changing their meaning under our tongues. Probably the main outline of a language will not change so much as it did in former times, because of printing and the general spread of knowledge. But smaller changes will always take place.

Take for instance an old English word "frampold," which was a good word in Shakespeare's time, and meant "peevish." It grew old like a yellow leaf, and fell away. Nobody today would have any idea what you meant if you spoke of "a frampold woman." On the other hand Shakespeare would not have the slightest idea what you were talking about if you could speak to him about a "telephone." But one of the most curious things is the way a word will sometimes remain in the language but change its meaning. The word "imp," for instance, once meant "offspring" or "scion," and there is a dignified old epitaph still in existence which begins, "Here lies that noble imp." How ridiculous that sounds today! Or take the word "host," which comes from the Latin *hostis* meaning "enemy." It has been so altered in meaning that now it means any army or large body of people, your own quite as well as your enemy's.

Philologists, or students of language, have discovered many interesting and unexpected things by this comparing of languages. By tracing the words from one tongue to another, and back to their original meanings, they have found for instance that many languages which at first sight seem to have nothing to do with one another are really related, much as cousins are related. And they have been able to puzzle out a good many facts about the original language from which many of the modern languages have developed. So philology helps out the other branches of science which deal with early man before our recorded history began.

Probably the most interesting discoveries have been in connection with the Indo-European languages, to which group our English language belongs. These languages are also called Aryan, and the people who spoke them were once all classed as Aryans; but nowadays the term Aryan as a race name is applied only to the eastern branch of the Indo-European peoples.

The scientists first made these discoveries by finding that Sanskrit, a dead language of India, was really a sister tongue to Greek and Latin and to the Germanic languages to which English belongs. With this as a key they were able to group almost all the languages of Europe and some of those of Asia into a system, and to make a good guess as to their origin.

The Mother Home of European Tongues

What they now think is that the original Indo-European root language grew up in the grasslands of the Caspian Sea. In course of time the people began to migrate, some going east and some west. As they got separated farther and farther from one another, and as the years passed, differences began to appear in their languages. At first if they met accidentally they could undoubtedly still understand one another, as a man from Boston can understand a man from Mississippi, though their speech is quite a little different. But after a few centuries these different groups grew so far apart in language that they could not understand one another at all, just as you cannot understand German without studying it, though English and German are rather closely related.

But certain words, or rather the "roots" of certain words, are found in all these languages, so we can be sure these words existed in the mother language. For instance, our English word "mother" is "mutter" in German, "mater" in Latin, "mētēr" in Greek, "matar" in old Persian, "macar" in Tokhar (Central Asia), and "mātā" in Sanskrit. By examining carefully which words are found thus in all the group languages the philologists have been able to make out certain things about the people who made the language in the first place. They seem to have been an agricultural people, with domesticated animals, and a definite form of government, and to have been in some ways rather highly developed, for their language had a complicated grammar, much more complicated in certain ways than our English language is today.

The study of comparative philology began in the last part of the 18th century. Sir William Jones in England had perhaps the first vision of its scope, but two Germans, Franz Bopp and Jacob Grimm—yes, he's the same one who helped collect the fairy tales—did the first thoroughly scientific groundwork. Max Müller, another German who taught at Oxford, also wrote many books on the subject. And today there are a host of philologists studying the subject, and every language and dialect, even the most unimportant, is being carefully studied.

Word Biographies in Your Dictionary

If you take any good unabridged dictionary you will find the "etymology," or history of the word, usually given in parenthesis after the word itself. These histories are often very interesting and they give the word a depth of meaning which you would never suspect otherwise.

The Indo-European group of languages mentioned above is divided into a number of smaller groups, of which the principal are: the *Hellenic*, which includes all the old Greek dialects; the *Italic*, which includes Latin and all the modern languages that come from Latin and are usually called Romance languages (Italian, French, Spanish, Portuguese, etc.); the *Celtic*, including Welsh, Gaelic, etc.; the *Teutonic*, including German, Norwegian, Swedish, Dutch, English, etc.; the *Slavonic*, including Russian, Polish, Serbian, etc.; the *Indic*, which includes Sanskrit and ancient Indian dialects, as well as the various modern dialects derived from these, like Hindustani; the *Iranic*, comprising Persian and several allied tongues; and the *Anatolic*, including Armenian, Phrygian, etc.

These Indo-European languages all belong to what is called the "inflected" languages; that is, they have a more or less complicated system of grammatical changes to indicate case, number, person, tense, and the like. There are however two other types of language. One type is inflected to a smaller degree than the Indo-European tongues, but has still the addition of prefixes, suffixes, and infixes to the root word. These are called "agglutinative" languages. To this class belong Turkish, Mongolian, many American Indian languages, etc. The third class is called "isolating," because in these languages each root-word, which represents a root idea, is a single monosyllable without additions of any sort. Chinese is the principal language of this group.

The languages which do not belong to the Indo-European group are divided into a dozen or so other groups, of which the most important are the *Semitic* family, which includes Hebrew, Phoenician, Arabic, Abyssinian, Syrian, etc.; the *Hamitic* family, which comprises Egyptian, Coptic, etc.; the *South-Eastern Asiatic*, or monosyllabic family, of which Chinese and Tibetan are the principal examples; and the *American* family, including the American Indian tongues.

Next to the Chinese, which is spoken in its various dialects by nearly 400,000,000 people, the English language is the most widely distributed, being spoken by about 160,000,000. It is said that German is spoken by about 110,000,000; Hindustani, 100,000,000; Russian, 100,000,000; French, 70,000,000; Japanese, 55,000,000; Spanish, 50,000,000; Italian, 50,000,000.

PHILOSOPHY. "It was owing to wonder," said Aristotle, "that men first began to philosophize—wondering at first about the problems that lie close at hand, and then little by little advancing to the greater perplexities." In this sense we all are occasionally philosophers. We philosophize when we reflect critically upon what we are actually doing in the world, upon the meaning of life, upon right and wrong, or how there came to be a world at all. The professional philosopher does, as his constant business, what other people do at moments. Touchstone's question—"Hast any philosophy in thee, Shepherd?"—is one with which Prof. William James says men should always meet one another; for "a man with no philosophy in him is the most inauspicious and unprofitable of all possible social mates."

The word "philosophy" comes from the Greek *philein*, meaning "to love," and *sophia*, meaning "wisdom." Hence "philosopher" originally meant "a lover of wisdom"; and although the word has since come to mean many things to many men, in its full sense it is only man thinking—thinking about generalities rather than particulars, trying to see all time and existence as a whole.

Today a study of the world and science and society is divided into many divisions. But at first there were no such separate departments of study, and the early philosophers studied subjects which today would be called astronomy, physics, or natural history, as well as logic, ethics, and metaphysics, which are now called philosophy. When we separate off one particular aspect of the world or of society and study that by itself, we usually call this a science; especially if we study something which we can count or measure exactly; but on the other hand if we aim not to get a precise statement of one particular part but instead try to find the meaning of the whole, we call it philosophy. Even in modern times Sir Isaac Newton, who formulated the laws of gravitation, is usually spoken of as a philosopher because he was taking a broad view of things.

Used in this same wide sense, philosophy has also a moral implication. Thus we often hear, "He took it philosophically," or "He is a real philosopher," when what is meant is little more than that his feelings were properly controlled by reason.

In a narrower and more technical sense, philosophy means *metaphysics*—the discussion of various abstract questions, all of them very broad and deep, which sciences and life suggest but do not solve. The sciences use such words as space, time, matter, and causality, without examining the meanings of the words; metaphysics asks such questions as: What are space and time? What is meant by a "thing," and how does it differ from an "idea?" How are mind and body joined? Do they act on each other? How does anything act on anything else? Is *good* a matter of opinion only, or does it have some existence outside of the mind? Metaphysics inquires into the cause, the substance, and the outcome of all things.

When you are judging right and wrong (which is the province of the branch of philosophy we call *ethics*) some consider that we can decide by reason; others believe that right and wrong are rather matters of feeling. When we ask what standard shall we actually use, some have held that the most important thing is whether our conduct produces happiness, and others whether it enlarges our life by making us more perfect. The first school are called *hedonists*, from the Greek word that means pleasure or happiness; the other school have been called by various names but most frequently *idealists*. Hedonists are further subdivided according as they emphasize the happiness of the person himself or the happiness of others as the true test. The first are called *egoists*, or sometimes *epicureans*, because the Greek philosopher Epicurus was the founder of a school which held this doctrine; the second group are sometimes called *altruists*. One particular group of altruists who were active in England in the early part of the 19th century are called *utilitarians*, or *Benthamites* after the English philosopher Jeremy Bentham (1748–1832). Their maxim was "the greatest good of the greatest number."

"Things" and "Thoughts"

Our knowledge of nature and our views about life may be regarded as having two parts. On the one hand we have to see or hear or touch, and on the other, we have to arrange or organize in our minds our ideas about what we see and hear and touch. We raise such questions as "What are things made of?" and "What is the cause of this or that?" Now some philosophers have emphasized the first of these subjects, and have thought that the particular things that we see and hear and touch are the more important. They then aim to form some general principles from examining these particular facts. This method is called *induction*, and the philosophers who use it are called *empiricists*, which means that they rely upon experience. On the other hand, some philosophers have been most impressed by the fact that if we can find a general law, such as that of gravitation, or set up some general standard of right and justice, we can then proceed to understand or judge particular facts by bringing them under this general law. If the book falls from the table, we explain it by saying that it is due to the law of gravitation. To begin with a general law or rule and proceed to particular cases is called *deduction*, and the philosophers who have tried to understand the universe by first grasping its general nature are called *rationalists*. They believe that by pure reason it is possible to make many statements about what must happen or what men ought to do.

A newer school, called *pragmatism*, has still another method of approaching these problems. Every idea, says Professor James, may be tested by the question, "What sensible difference to anybody will its truth make? If you claim that any idea is true, assign at the same time some difference that its being true will make in some possible person's history, and we shall know not only just what you are really claiming, but also how important an issue it is, and how to go to work to verify the claim." This method neglects the content of an idea and follows its use only, under the theory that the use is the real test of its truth and meaning. The idea is true and its truth demonstrated if it works.

Pragmatism was first formulated by C. S. Peirce, an American scientist. Prof. William James developed and popularized it and became the leading pragmatist. Prof. John Dewey belongs to this school.

When you study the world it is very evident that there is a sense in which there are a great many separate things, such as rocks and trees and persons; there is also a sense in which we say that our body is one thing and our mind is another. But on the other hand it seems equally clear that all these separate things are in some sense related to one another; that is, are not entirely separate but, as it were, one. A man's mind and body together make up one person, and every part of the universe is probably affected by every other part. Those philosophers who have emphasized the unity of the world are called *monists*, and those to whom the distinctions and separateness between things seem most important are given the name of *pluralists*.

Materialism and Idealism

Perhaps the simplest distinction in our world is that between persons and things. Persons are alive and think and move of their own will; things do not move unless they are acted upon by some other thing or by a person. Some philosophers have thought of the world as though it were all made up of things, or to use the technical term, of matter. They have been called *materialists*. Others have believed that the world is to be regarded rather as though it were to be understood also as mind; and they have been called *idealists*.

Besides metaphysics and ethics, there are two other important divisions of philosophy; *logic*, which is the science of thinking and of classifying arguments into good and bad; and *aesthetics*, the science of the beautiful, in its broad sense—including the sublime, comic, tragic, pathetic, and ugly.

The first people to think systematically about the great questions of the universe and give philosophy a meaning were the ancient Greeks, represented by such famous names as Thales, Heraclitus, Democritus, Aristippus, Socrates, Plato, Aristotle, Pythagoras, Epicurus, Zeno, and Diogenes (*see* Aristotle; Epictetus; Plato; Pythagoras; Socrates).

The Romans borrowed their philosophy, as they did most of their arts and sciences, from the Greeks. Lucretius, Cicero, Marcus Aurelius, Epictetus, Plotinus, and Boethius all carried on the Greek tradition in one form or another (*see* Cicero; Marcus Aurelius Antoninus).

After three centuries of intellectual darkness, a new school of thinkers arose, who attempted to harmonize the doctrines of Aristotle with the teachings of the church. This system, known as Scholasticism, was the creation of such famous medieval philosophers as Duns Scotus, Thomas Aquinas, Peter Lombard, Abelard, Anselm (*see* Abelard).

The stimulating influence of the Revival of Learning burst the fetters of scholasticism and impelled men to strike out into new paths of philosophic thinking. Francis Bacon, the great English philosopher, laid the foundations of modern empiricism, and the Frenchman Descartes established the principles from which modern rationalism sprang (*see* Bacon, Lord Francis).

During the last three centuries important contributions to philosophic progress have been made in each of the leading nations of Europe, as well as in our own country. The outstanding names in England are Thomas Hobbes, John Locke, George Berkeley, David Hume, Dugald Stewart, Jeremy Bentham, John Stuart Mill, Herbert Spencer, T. H. Green, and F. C. S. Schiller. Germany produced such epochal thinkers as Leibnitz, Kant, Fichte, Schelling, Haeckel, Schopenhauer, Nietzsche, Hartmann, Lotze, Herbart, and Wundt. France is represented by Malebranche, Condillac, Diderot, Rousseau, Voltaire, Comte, Cousin, and Henri Bergson. Holland produced the great Spinoza. The United States is chiefly known by the work of Jonathan Edwards, Ralph Waldo Emerson, Josiah Royce, William James, George Trumbull Ladd, John Dewey. (*See* Emerson; Rousseau; Voltaire.)

PHLOX. These hardy garden flowers yield a wealth of bright-colored clustered blossoms throughout the summer and early autumn. About 30 species are native to North America. The tall-growing showy border phloxes have salver-shaped flowers, ranging in color from pure white to almost bright scarlet, passing through shades of pink, purple, magenta, lilac, and salmon. They are divided into early and late blooming kinds, the most common variety of the latter being cultivated from the wild sweet-william (*Phlox maculata*). The dwarf perennials, trailing and tufted in habit, make a charming edging to our flower beds. They too have great variety of color, and succeed in poorer soil and drier places than the tall plants. Perhaps the best known of these is the moss pink. It grows only about six inches high and has prostrate stems and dense masses of blossoms that completely hide the thick mats of mosslike foliage. In early May it makes a brilliant carpet in our gardens.

Scientific name of moss pink, *Phlox subulata*. Flowers about one inch across, growing in small clusters; five-lobed tubular calyx; salver-shaped corolla of five lobes, notched or entire; five stamens in corolla tube; stem matted, much branched, leafy; leaves crowded, narrow, sharp-pointed, usually stiff with hairy margins.

PHOENICIANS (*fĕ-nĭsh'ĭ-ănz*). More than 2,000 years before the days of Columbus, keen-eyed dark-skinned mariners anchored their well-laden ships from Phoenicia off many a shore of the blue Mediterranean and even beyond in the unknown seas. The people came flocking down to purchase their wares, for the Phoenicians were the great merchants of ancient times. Through their hands passed the rich treasures of every known land—perfumes and spices from the Far East; fine linen from Egypt; wool from Arabia, woven into robes of pure white or rich purple; vessels of brass, silver, and gold, wrought by their own skilled artisans; ornaments of carved ivory; emeralds, coral, agate, and amber; and other stores yielded by bountiful Nature or devised by clever man.

These Phoenicians (the Canaanites or Sidonians of the Bible) belonged to the Semitic race. Their country was a narrow strip of the Syrian coast about 200 miles long and about 20 miles wide. It was a land of meadows and pastures, of orchards and vineyards, but so scanty that the Phoenicians were fairly pushed off to sea for a living. Surpassing their teachers the Egyptians, they became the most skilful shipbuilders and navigators of their time. They passed through the Straits of Gibraltar, worked the silver mines of Spain, founded the city of Cadiz on the western coast, sailed as far as the British Isles in quest of tin, and are said to have even sailed around the southern point of Africa. They founded many colonies, the greatest being Carthage, which in turn established colonies of its own and grew into a great empire and rival of Rome (*see* Carthage).

The Phoenicians acquired the arts and industries of many lands and passed them on to the rest of the world. They developed the art of glass-making which they learned from the Egyptians. They knew how to mine and work metals. They wove cloth of fine texture and beautiful design. From a little shellfish, called *murex*, they obtained a dye of beautiful purple (or more properly crimson).

But the most precious gift the Phoenicians gave the western world was the alphabet. They early found the clumsy clay tablets of Babylonia inconvenient for keeping their accounts, and so they imported papyrus paper from Egypt, and devised an improved alphabetic system of 22 signs for writing their language. The Greeks with whom they traded were quick to see the advantage of the Phoenician alphabet and soon began using it to write their own language. Thus it is from the Phoenicians, through the Greeks and Romans, that we derive our own simple and practical alphabet (*see* Alphabet).

The Wealth of Tyre and Sidon

There were two great cities of Phoenicia—Sidon the center of the glass industry, and Tyre the center of the purple industry. In the middle of the 10th century B.C. Tyre assumed the leadership of all Phoenicia. Friendly relations were established with the Hebrews, and King Solomon sent to King Hiram of Tyre not only for materials but for skilled workmen to build the temple, for there were none with "skill to hew timber like unto the Sidonians."

In the 6th century the Phoenicians supplied the great fleets with which Darius and Xerxes attacked Greece. For the most part they submitted readily to their foreign masters and were allowed to retain a certain degree of independence and pursue their commercial ambitions undisturbed. Alexander the Great in 333 B.C. took Tyre, after one of the greatest sieges of history. In 64 B.C. Phoenicia came under the control of the Romans, and under their rule the native language and institutions soon became extinct.

The Phoenician religion was a form of Nature worship; their chief divinities were the god Baal and the goddess Astarte, or Astoreth. In times of great distress human sacrifices were offered to the god Moloch. Many of their religious practices were barbarous and degrading.

Today the small island on which the 25,000 inhabitants of Tyre once crowded into lofty many-storied houses is connected with the mainland by a broad tongue of land, which has grown out of the mole built during Alexander's siege; and the site is occupied by an unimportant town of 5,000 (Sur). Luxuriant fruit gardens cover the place where Sidon once stood, furnishing the main support of the 15,000 inhabitants of the modern city of Saidi.

PHONOGRAPH. Of all things sound is one of the most fleeting. Fragile ferns and mosses, perishing before there was an eye to behold them, have left imprints for after-ages to wonder over; but of the singers and orators of past generations who thrilled vast audiences, every tone was irretrievably lost as soon as uttered. What would we not give for a miracle which would enable us to hear Homer chanting the fall of Troy, or Demosthenes hurling invective against Philip of Macedon, or even the loved lost voices of former days?

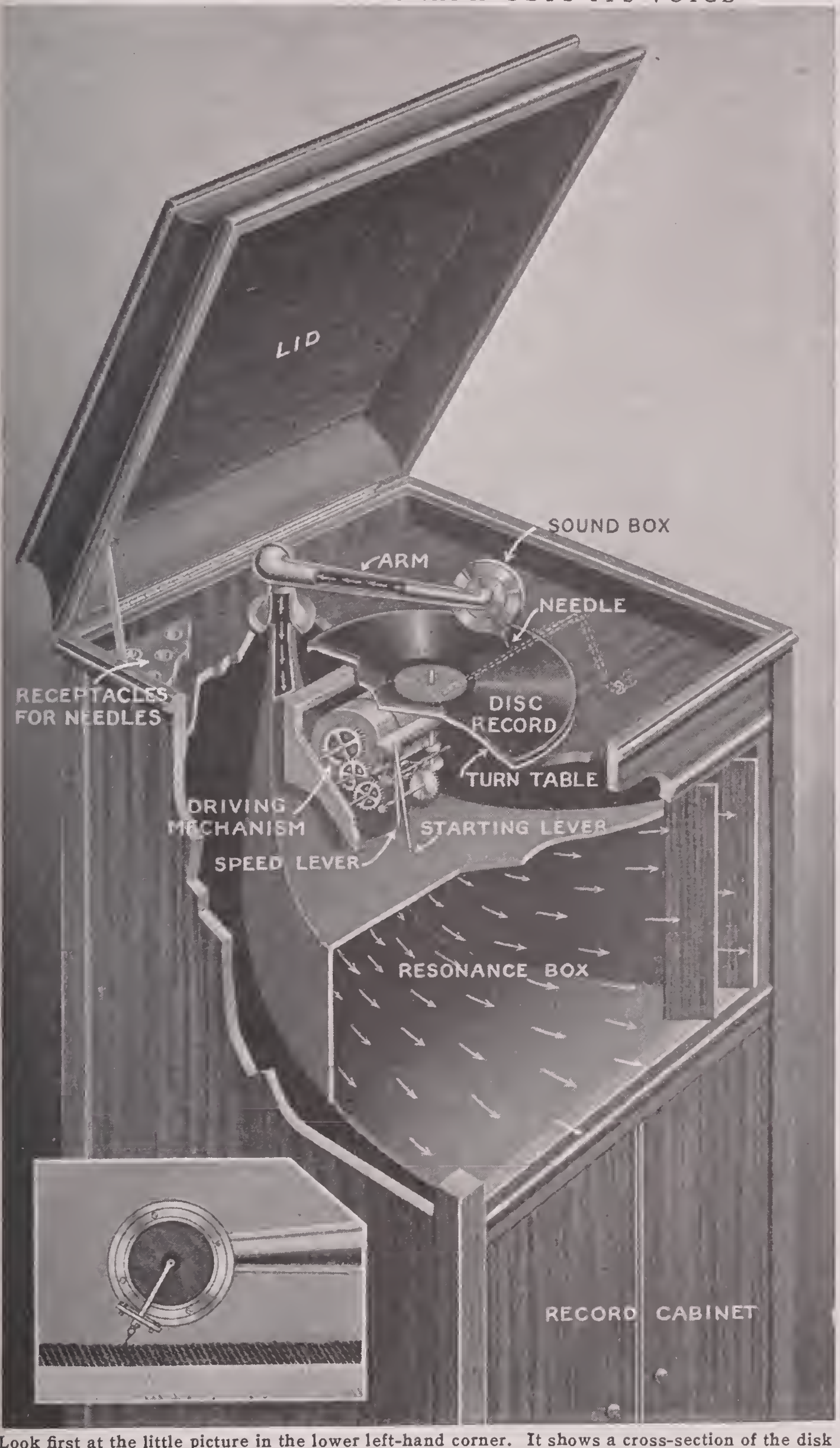
The miracle which enables future generations to hear the music, the speech, the very tones and accent of today was worked out by an American in 1877. Sound is produced by vibrations of the air, and the changing form of these vibrations can be traced, recorded, and reproduced. (*See* Sound.) When this discovery was made, the miracle of the phonograph was as good as performed. Thomas A. Edison was not the first man to draw this very obvious deduction, but he was the first to provide a commercially practical means for recording and reproducing the vibrations of sound. Such instruments are variously called "phonographs," "gramophones," "graphophones," or simply "talking machines."

The basic principle of Edison's invention is the same as that employed in the transmitter and receiver of the telephone. When sound waves strike against a very thin flexible disk, called a diaphragm, they cause it to vibrate. If the process is reversed, and a diaphragm is made to vibrate by some mechanical means, it will in turn cause vibrations in the air which will affect the ear as sound.

In order to record sound, Edison attached a cutting needle to the center of a diaphragm and allowed it to rest against a cylinder covered with tin-foil. This cylinder he kept revolving rapidly, and also slowly advancing endways, so that the needle described a spiral path around it.

When this apparatus was set in motion, and sound was directed against the diaphragm, the needle dug into the tin-foil along its spiral path. Thus the cylinder was made to record the movements of the diaphragm. If the spiral groove on such a record be examined under a magnifying glass, it will appear as a succession of humps and hollows, so close together that while the cylinder is turning several hundred pass during one second.

WHERE THE PHONOGRAPH GETS ITS VOICE



Look first at the little picture in the lower left-hand corner. It shows a cross-section of the disk record, with the "humps and hollows" very much enlarged. These set the needle vibrating as it passes over them; the vibrations are amplified by the sound box; and the sound is then conducted out through the resonance box, as you see in the larger picture.

In order to reproduce the original sound the process was reversed. The cylinder was set turning, with the needle resting in the groove. The needle dropped into the hollows and was driven outward by the humps; and this motion was communicated to the diaphragm, causing it to give off vibrations similar to those of the original sounds. In other words, Edison's machine now "gave out" the same sounds which had before been "put in," playing the part, one might say, first of the human ear, then of the voice.

The phonograph of today is essentially the same as this early instrument of Edison, though many improvements were necessary before it reached its present pitch of perfection. The most important of the early developments was the substitution of a wax cylinder for the cylinder covered with tin-foil, which after a few repetitions became so worn as to be useless. Later the wax cylinder was replaced for most purposes by the disk form of record. This has several great advantages. First, the flat disks greatly economize space in the phonograph "library," both because they take less room and because records can be made on both sides. Second, they are more durable. Next, the driving mechanism is simplified, since a single turntable movement is all that is necessary, while the cylinder type requires additional mechanism to give it the slow endwise motion. And finally, the multiplication of records for sale is made much easier. Only a single record, of course, is made direct from the singer's voice or the orchestra, and it is more precious than gold. To reproduce this the original or "master" record is dusted with graphite and electrotyped (*see*

Electrotyping). From this mold thousands of records are stamped almost as easily as a sheet of paper could be printed in the days of the hand press. These disks are made of various "synthetic plastics"—some of them derivatives of coal-tar—the secret of the manufacture having long been jealously guarded (*see* Coal-Tar Products).

Delicate clock-work apparatus, driven by a spring or a little electric motor, is used to revolve the record with the absolutely regular motion essential, for the slightest change of speed alters the pitch of the sound. Much ingenuity has also gone to the perfecting of the horns and cabinets used to amplify the sound. One of the most difficult problems of the phonograph has been the elimination of the hissing sound produced by the friction of the needle as it passes over the record. In some machines this has been overcome by sound filters in which the vibrations are made to travel through a tube filled with substances which absorb or "damp" the short waves of the high-pitched friction noises. Disk records are usually played with sharp-pointed needles made of steel or bamboo fiber, which ordinarily are used but once because of the danger of damaging expensive records with worn needles. Needles tipped with tungsten or other harder metal are also made and can be used for a number of records without injury. Most cylinder records and certain types of disk records are played with a ball-tipped stylus of glass or sapphire, or with a diamond point, which can be used for a long time but must be discarded as soon as any sign of wear appears. The diaphragm may be made of any elastic solid, usually glass or mica. No matter what the material, any diaphragm is said to "tire" in time, emitting a muffled tone.

Getting the Sounds to Blend

Making a record is a most delicate and interesting operation. The greatest pains are necessary to get the best artistic results, in which voice and instruments blend into the same superb unity obtained in the concert hall. The places of the various players and singers are determined with great precision to get the exact relative prominence for each, and often the recording instrument is provided with several horns to produce the proper blending and concentration.

Aside from its value as a source of amusement and entertainment, the phonograph has proved useful in a score of ways. Perhaps its chief accomplishment has been carrying good music and an appreciation of good music the world over. The phonograph has done for music what the printing press did for books. Millions who will probably never hear any of the world's greatest singers or orchestras at first hand have been thrilled by their artistry through the medium of the phonograph. The music student can familiarize himself with the world's masterpieces and study their construction. Phonographs are also used to teach languages and music. Educational records are prepared for schools. Blind students and scholars find the machines of great value. Scientific men have used them to collect records of vanishing languages and the songs and folk-lore of peoples that are dying out or losing their own languages and customs. Collections of phonographic records of the voices of distinguished persons have been started by the British Museum, the Paris Opera House, and other similar agencies, in addition to the permanent collections housed in the vaults of all the large manufacturing companies. The dictaphone is the application of the phonograph principle to the uses of commercial correspondence (*see* Dictaphone).

PHOSPHORESCENCE (*fŏs-fŏr-ĕs′ĕns*). What is the secret of the firefly's glow? Why does decaying wood emit a faint light visible in the dark? Why do summer seas, where certain microscopic animals are numerous, flash and glow when rippled by wave or oar or the prow of a ship?

Phosphorescence is the name given to a variety of such phenomena, all consisting in the giving out of a pale light, not apparently due to combustion. The problem of phosphorescent substances has puzzled people from early times, and indeed is not yet wholly solved. We know that certain mineral substances, such as barium sulphide, calcium sulphide, and calcium nitrate, after having been exposed to the light and then removed into the dark, glow with a faint light for some hours. Hence these substances are used to paint the hands and dials of luminous watches.

The emission of light by living creatures, such as the fireflies, centipedes, and glowworms, is caused by oxidation or the union with oxygen of the materials of their bodies, probably the fats. Many bacteria and molds which cause decay are phosphorescent. This is why decaying wood and dead fish frequently give off light. The phosphorescence of the sea is due to the small luminous organisms which are present. Many of the deep sea fishes have luminous or light-giving organs. The phosphorescence of the firefly, we know, is not dependent upon life, for the dried and powdered abdomen will emit light again in the presence of air and moisture.

PHOS′PHORUS. Perhaps the most common use of phosphorus is in making the friction matches which enable us to get fire so much more easily than our forefathers (*see* Matches). At temperatures below 95° F. ordinary phosphorus is an almost colorless or faintly yellow solid substance, having the glistening appearance and consistency of wax. Perhaps its most striking characteristic is that it glows in the dark with a greenish-white light, due to its slow combustion or oxidation. It is so inflammable as to burn by mere friction at ordinary temperatures. Even the warmth of the hand may set it afire, and it must be kept in water lest it may spontaneously burn. In experiments care must be taken or the hands will be severely burned.

Phosphorus shines in the dark, from the slow combustion it undergoes. Taken internally, it is a powerful irritant poison; emetics should be given at once, and a dilute solution of copper sulphate. Persons engaged in the manufacture of matches are frequently seriously affected by it. Decay of the jaw-bone (called "phossy jaw") is of common occurrence among such workers. This danger has been overcome to some extent by the use of red phosphorus, one of the "allotropic modifications" of the pure element, with very different physical properties from the ordinary form. Red phosphorus is non-poisonous, does not shine in the dark, vaporizes instead of melting, and does not catch fire below 260° C. (500° F.) while ordinary phosphorus breaks into flame at 35° C. (95° F.). Red phosphorus is prepared by heating ordinary phosphorus in closed retorts.

Phosphorus, being one of those brisk sociable elements, never found uncombined in nature, was not discovered until 1669. It was founa by an alchemist named Brand, searching for the philosopher's stone. It occurs in combination in the mineral apatite and other rocks, in guano, and in bones, muscles, nerves, brain, and other body substance—for, poisonous though the element is, its compounds are necessary to life and are an essential constituent of all fertile soils (*see* Fertilizers). Egg-yolks and beans are foods containing a large phosphorus supply.

Commercial phosphorus is obtained from bones and "phosphate rocks" formed from fossil bones. Large deposits of these phosphates are found in Florida, Georgia, the Carolinas, and other states. The old process of treating the ash from burned bones or rock with sulphuric acid to break up the calcium phosphate has been almost entirely replaced by a process of direct reduction in an electric furnace. Carbon, sand, and phosphate are mixed and heated; calcium silicate is drawn off as slag, while the phosphorus vapors pass off into a condenser.

The MECHANICAL EYE *that* SEES FOR ALL

PHOTOG'RAPHY. Nature usually performs her tasks much better than any machine, but in the matter of vision the "mechanical eye" invented by man in most ways far surpasses nature's best efforts.

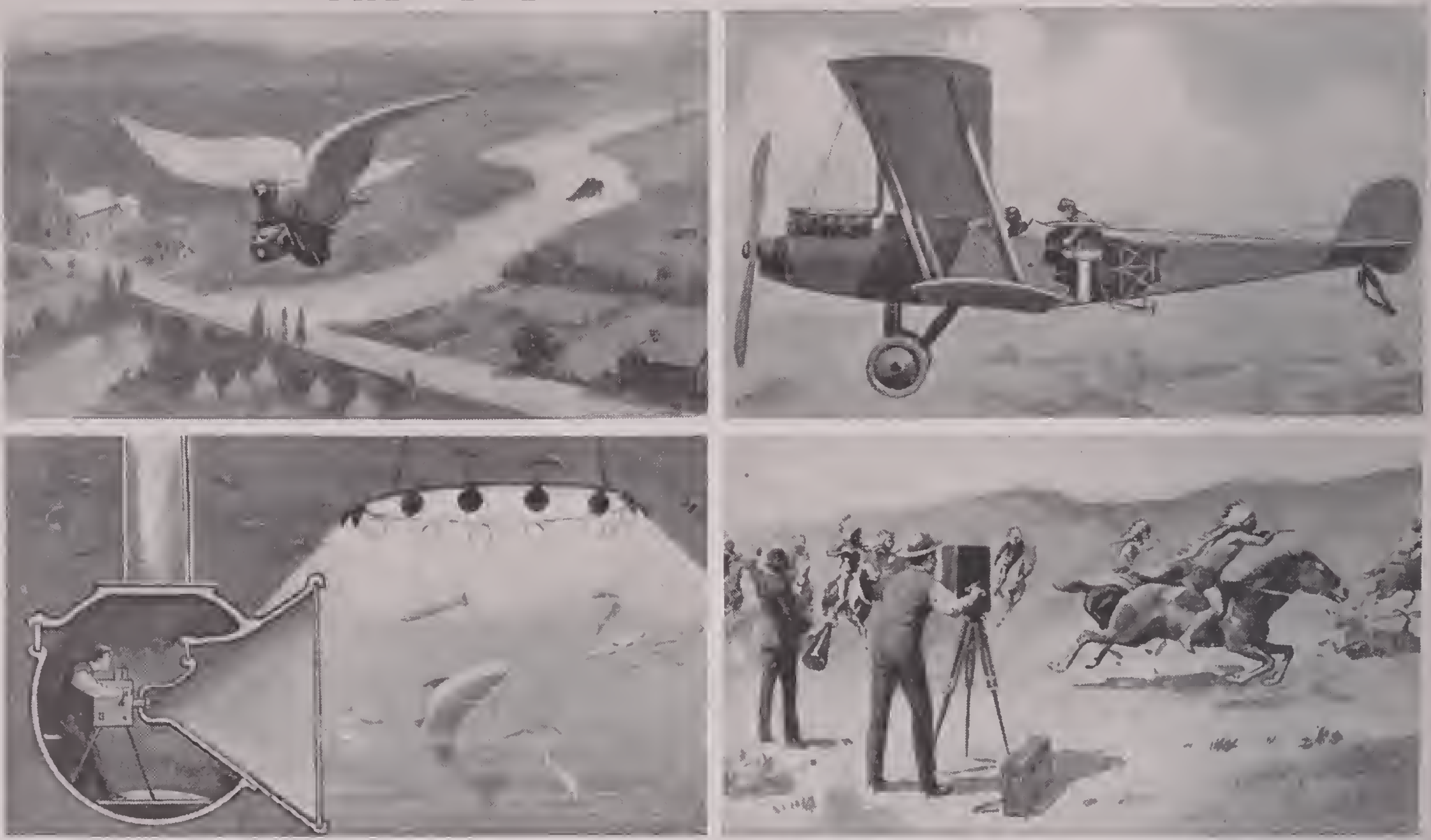
The photographic camera can "see" stars that are invisible to the human eye even through the most powerful telescope. It can catch a glimpse of a bullet as it whizzes through the air. In one three-thousandth of a second it can seize and set down all the countless details of a great crowd on a bathing beach. It can give you a large picture of the tiniest microbe, and a tiny picture of the Pyramids of Egypt.

Besides, by the processes of photography any number of accurate copies of a picture can be made and printed in newspapers, magazines, and books. In this way the inhabitants of every part of the world can really see and enjoy the wonders of the world for themselves, no matter how rare or distant these wonders may be.

Photography, or "light writing," to translate the Greek words, has become so common in the last 50 years that most people have stopped wondering about it. But when we think of the amazing power this discovery has put in the hands of the human race, it is easy to understand why it has been called, next to printing, the greatest of all educational factors.

If you consult books of natural history printed 50 or 100 years ago, you will realize what photography

THE ADVENTURES OF THE CAMERA



Wherever there are wonders to behold, there the camera goes to bring back the picture story for those who stay at home. Did you know, for instance, that tiny cameras had been made to be strapped to homing pigeons? As the pigeon flies—perhaps it is in time of war over the enemy lines—the camera, which is operated by clockwork, clicks at regular intervals, bringing home the record of what it has "seen." At the right we see how the airplane camera is mounted to take "map-photographs" of the ground below. Next we see a motion picture man in a diving chamber photographing sea life by the light of powerful submarine lamps. Last is the "filming" of a photo-play.

has done to spread knowledge. The animals pictured in those old books all look stiff and unnatural, and some of the rarer creatures would not be recognized at all from the drawings. That was because the scientists and explorers of those days were the only ones who had actually seen these creatures, and these men could draw only very crudely what they saw, or the best draftsman could reproduce only very roughly what the explorer described.

The Camera's Life of Travel and Adventure

Today the camera sees, and sees with absolute accuracy, for everybody. It goes into the heart of Africa, and to the South Pole; it braves the dangers of the battlefield, soars above the clouds, and becomes the unfailing eye of the army air scout. It has even penetrated beneath the surface of the ocean and shown sharks attacking their prey. It unfolds the mysteries of insect and plant life in all their minute and complicated detail.

In its most recent development, photography has set all the wonders of the world in motion before human eyes and has created a new form of drama, but that amazing achievement is a separate story in itself (*see* Motion Pictures).

What is it then that makes all this possible? It's really a very simple thing, the same thing that makes a carpet fade if the sun shines on it for long. In other words, it is the power of light to cause chemical changes. Scientists call this *actinism*.

To understand how this works out let's go into a photographic gallery and see what happens between the time the photographer points the camera at a "subject" posing in a chair and the time the photograph is finished.

Getting Inside of a Camera

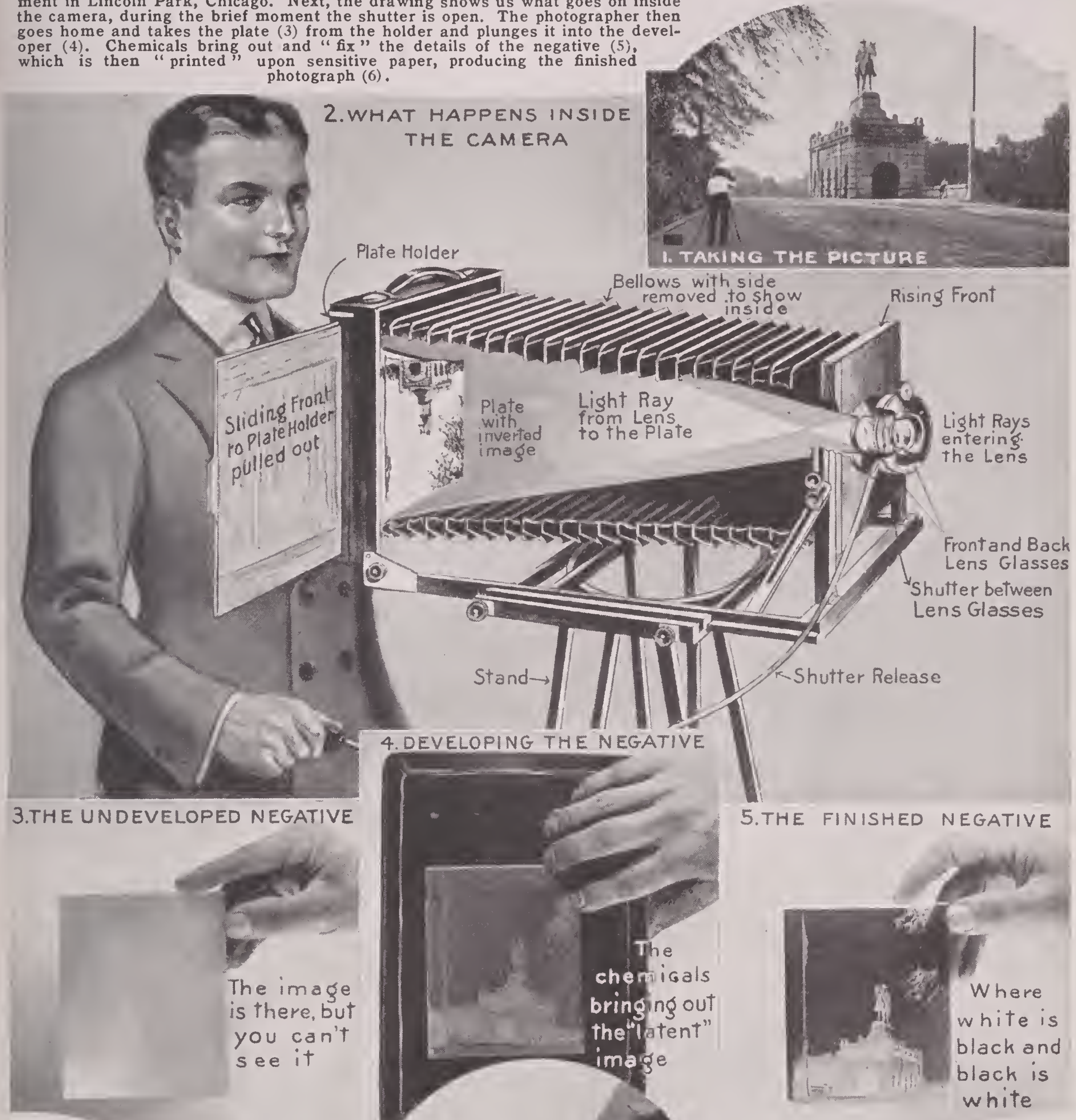
First, let us get inside and look at the camera itself. It is a boxlike affair, and in front projects a short tube containing the lens or "eye" of the camera (*see* Camera). Inside this tube also is the shutter, a device which may be opened or closed at will, thus letting in or shutting out the light through the lens. The sides of the camera are equipped with leather bellows like an accordion, so the front and back of the instrument may be moved closer together or farther apart. At the rear is a ground glass "window."

If you watch this ground glass with the photographer, as he opens the shutter and screws the front of the bellows-like camera backward and forward, you will see appear upon it a small image of the subject. This image will be upside down, but it will be perfectly clear.

How is this image made? All objects, you know, reflect or throw back at least a portion of the light that falls upon them. White and the bright colors reflect the most, black and dark colors the least. If it were not for this kind of reflection we could not see the object at all, nor could we distinguish brightness from darkness (*see* Light).

PUTTING A VIEW ON PAPER—THE HISTORY OF A PHOTOGRAPH

First, we see the photographer taking the photograph—the famous Grant monument in Lincoln Park, Chicago. Next, the drawing shows us what goes on inside the camera, during the brief moment the shutter is open. The photographer then goes home and takes the plate (3) from the holder and plunges it into the developer (4). Chemicals bring out and "fix" the details of the negative (5), which is then "printed" upon sensitive paper, producing the finished photograph (6).


1. TAKING THE PICTURE
2. WHAT HAPPENS INSIDE THE CAMERA
Plate Holder
Bellows with side removed to show inside
Rising Front
Sliding Front to Plate Holder pulled out
Plate with inverted image
Light Ray from Lens to the Plate
Light Rays entering the Lens
Front and Back Lens Glasses
Shutter between Lens Glasses
Stand
Shutter Release
3. THE UNDEVELOPED NEGATIVE
The image is there, but you can't see it
4. DEVELOPING THE NEGATIVE
The chemicals bringing out the "latent" image
5. THE FINISHED NEGATIVE
Where white is black and black is white

Now the lens of the camera, like the human eye, collects reflected rays of light from every part of the object in front of it, and after criss-crossing them brings them all together again in their proper order, but inverted, forming an image (*see* Lens). The camera lens will form this image even in the empty air, but in that case it cannot be seen until something is put in the way to reflect it. If we put the ground glass at the point where the image is formed, so as to catch and hold the light rays, the image becomes visible. But the distance behind the lens at which this image is formed varies with the kind of lens used and also with the distance of the object itself from the front of the camera. That is why it is necessary to screw the front of the camera back and forth to find the exact point where the image is clear. This is called "focusing."

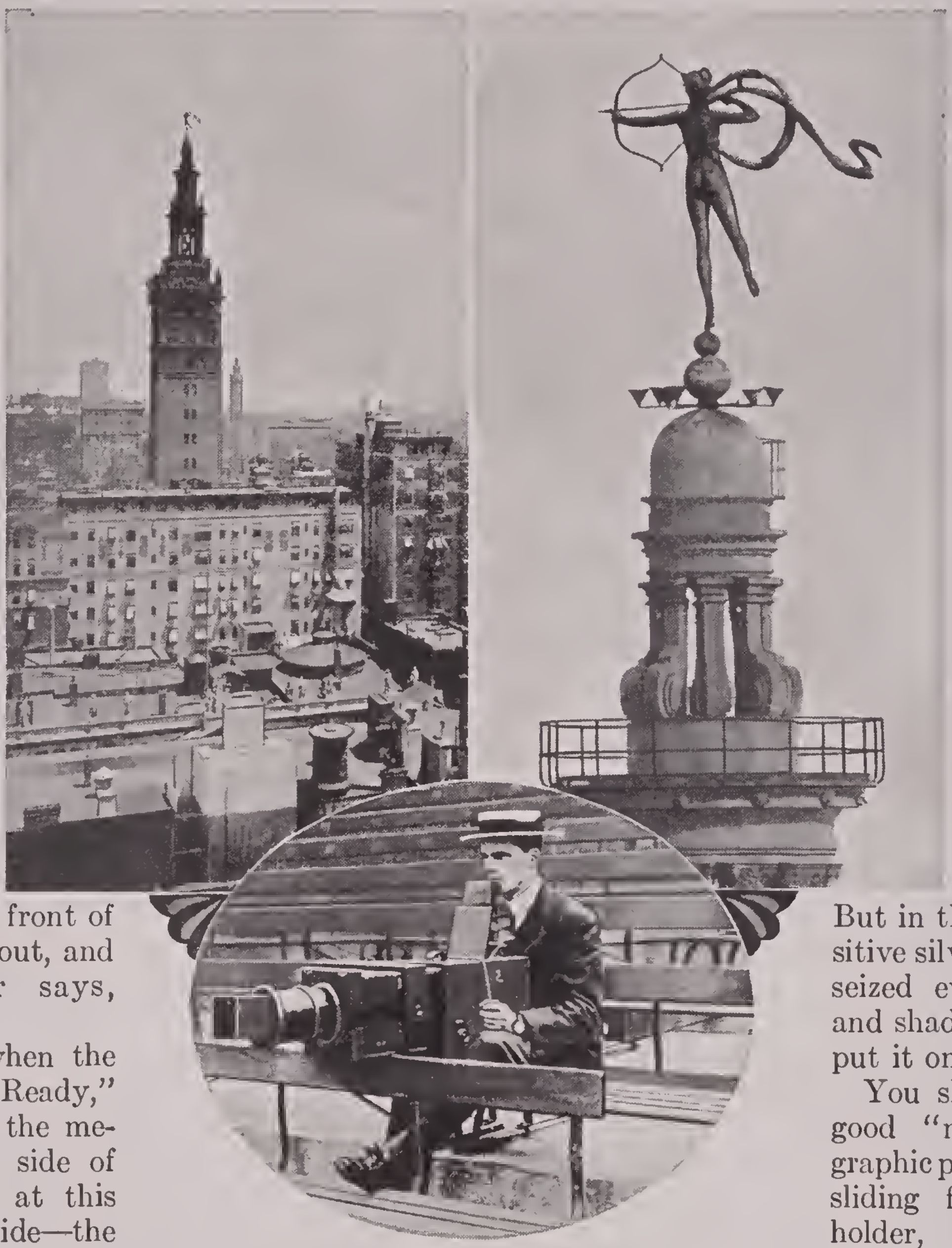
Now let's go back to our photographer. He has focused the camera properly, and now he closes the shutter, cutting off the light through the lens. He then brings out a sort of box, which is nearly as broad and long as the back of the camera, but only about three-quarters of an inch thick. This is called a plate-holder. It is absolutely light-tight, but has a sliding front that can be pulled out at the proper time, exposing the photographic plate inside. This plate-holder is fitted into the back of the camera in such a way that it occupies exactly the same place that the ground glass did before. The sliding front of the holder is pulled out, and the photographer says, "Ready."

Up to the time when the photographer says, "Ready," you have seen only the mechanical and optical side of photography. But at this point the chemical side—the really important side—begins.

Let's stop again, therefore, and find out what's the nature of this wonderful photographic plate, which is the heart of the whole process. Without it there could be no such thing as photography.

We have seen that photographic action depends on the same principles as the fading of a carpet by the sun. But this fading of a carpet is, as we know, very slow. Now there are certain wonderfully sensitive chemicals which, when light falls upon them, change their nature with the speed of lightning. The most important of these belong to the class known as silver salts, that is, they are combinations of the metal silver with certain other chemicals. The silver salt most often used is silver bromide.

THE CAMERA WITH THE TELESCOPE EYE



The two upper pictures were taken from exactly the same spot and with the same camera. But see the difference! The one at the left was made with an ordinary lens, and you can barely distinguish the statue on top of the tower. But in making the one at the right a "telescopic" lens was put in place of the ordinary lens. In the picture below we see a type of telescopic camera often used for getting pictures of races and other athletic events.

In making photographic plates, therefore, a thin smooth coating of gelatin containing the silver salt is applied to one side of the glass and dried. These plates are then carefully sheltered from the light up to the time of making the exposure, as the process of opening the shutter and taking a picture is called. That time has now come. The photographer has said, "Ready"; the sitter tries to look natural; there's a faint click as the shutter opens and closes; and the miracle has been accomplished.

Here's what happened during the fraction of a second that click lasted: The light rays reflected from the sitter flashed through the lens; for an instant they formed on the coated surface of the plate the same image you saw before on the ground glass; then the light flashed off again. But in that instant the sensitive silver salt on the plate seized every detail of light and shade in that image and put it on record.

You shall now see what a good "memory" a photographic plate has. Closing the sliding front of the plate-holder, the photographer takes it out and goes into the darkroom. This is a room lighted only with dim orange or red lights, which are the safety lights of photography. As he removes the plate from the holder, you feel that something must have gone wrong. There's nothing on the plate but a blank yellow coating. But wait! He puts it in a tray and pours a liquid over it. In a minute or so you see dark patches appear, then some lighter patches, and soon the outlines of a human face. Presently he washes the plate in running water and puts it in another tray full of liquid. Some minutes later he takes it out, turns on a bright light, and examines it.

Well, this is the queerest picture you ever saw. Everything is backward. All the white places, like

WHEN PHOTOGRAPHY BECOMES A TRUE ART

In the hands of a person who has an " eye for beauty," the camera can be made to produce pictures of great artistic beauty, such as the one you see here. " Composition " or the proper grouping of figures and objects against the background is the most essential part of artistic photography, while the careful choice of lighting effects is the second requirement.

the face and collar and hands, are black and dense, and all the dark places, like the eyes and maybe the clothes, look white and transparent. That's because this is only the negative—the first step in getting the finished picture.

While the negative is being washed and dried, let's see what happened to the plate in the dark-room during those last few minutes. First, you must think of the silver salt on the plate as a chemical compound in which the silver held its companion, the bromine, a prisoner. When the rays of light through the lens struck the plate they loosened the hold of the silver upon the bromine, and wherever the brightest rays struck, this hold was loosened the most. But the bromine could not escape without the assistance of another chemical called the developer. As soon as this was poured on, all the bromine that could possibly get away fled to its new friend, leaving the silver stuck in the gelatin coating.

In some places nearly all the bromine escaped, in others less, and so on down to the darkest parts of the image, where scarcely any was released. This, of course, left a good deal of the original silver salt still on the plate, ready for any stray ray of light to set it free and spoil everything. So the plate was put in another chemical bath, the fixing solution (composed of sodium hyposulphite, usually called "hypo" for short). This dissolved away all the remaining silver salts, producing the finished negative, which is now no longer sensitive to light, since all the details in it are composed of pure metallic silver imbedded in the gelatin—the greatest amount of silver being in the places that received the brightest light, such as hands, face, etc.

The photographer now takes the dried plate back into the dark-room and puts it into a device that looks like a picture frame, which opens in the back. Behind the plate he then adjusts a piece of paper of the same size, and closes the frame. He turns on a bright electric light, exposes the frame in front of it for a few seconds, then takes out the paper, and puts it in a tray with another developing solution. In a few moments the real picture appears, with all the lights and shades in their proper places. This is then dropped in the fixing solution for several minutes, washed thoroughly in water, and dried. The photograph is complete and ready for mounting.

These operations, known as printing, are much the same as the processes used to make the negative. The paper behind the negative was coated with a sen-

"CAUGHT" IN MID-AIR!—A MARVEL OF SPEED PHOTOGRAPHY

One of the most amazing things about modern photographic plates and films is the quickness with which they can "catch" a picture. The flash of the image for a thousandth of a second or even less is enough on a bright day to impress the sensitive chemicals. This makes possible pictures like the one you see here—a diver snapped in the midst of his downward plunge.

sitive silver salt, similar to that used on plates, but much less rapid in action. The light struck through the transparent places on the negative, turning the paper beneath them dark, but was stopped by the dark places, leaving the paper white. That's how the face and hands got white again and the clothes returned to their proper dark shading.

There is, of course, endless variety in the minor details of photograph-making, such as the use of slow or fast plates, and of countless kinds of printing paper, giving different finishes and different shades of color from light blue to dark brown or sepia. There are also innumerable combinations of chemicals used as developers. But the operations we have followed represent all the fundamental principles of photography, and once these are clearly understood, the other processes can be easily mastered.

The speed with which photographs can be taken, developed, and printed in emergency cases is of immense value to modern newspapers. By also hastening the process of photo-engraving, which prepares the picture for the printing press, papers containing photographs of some great event are often sold on the street an hour after the event took place.

IN THE SHADOWS OF THE SEA

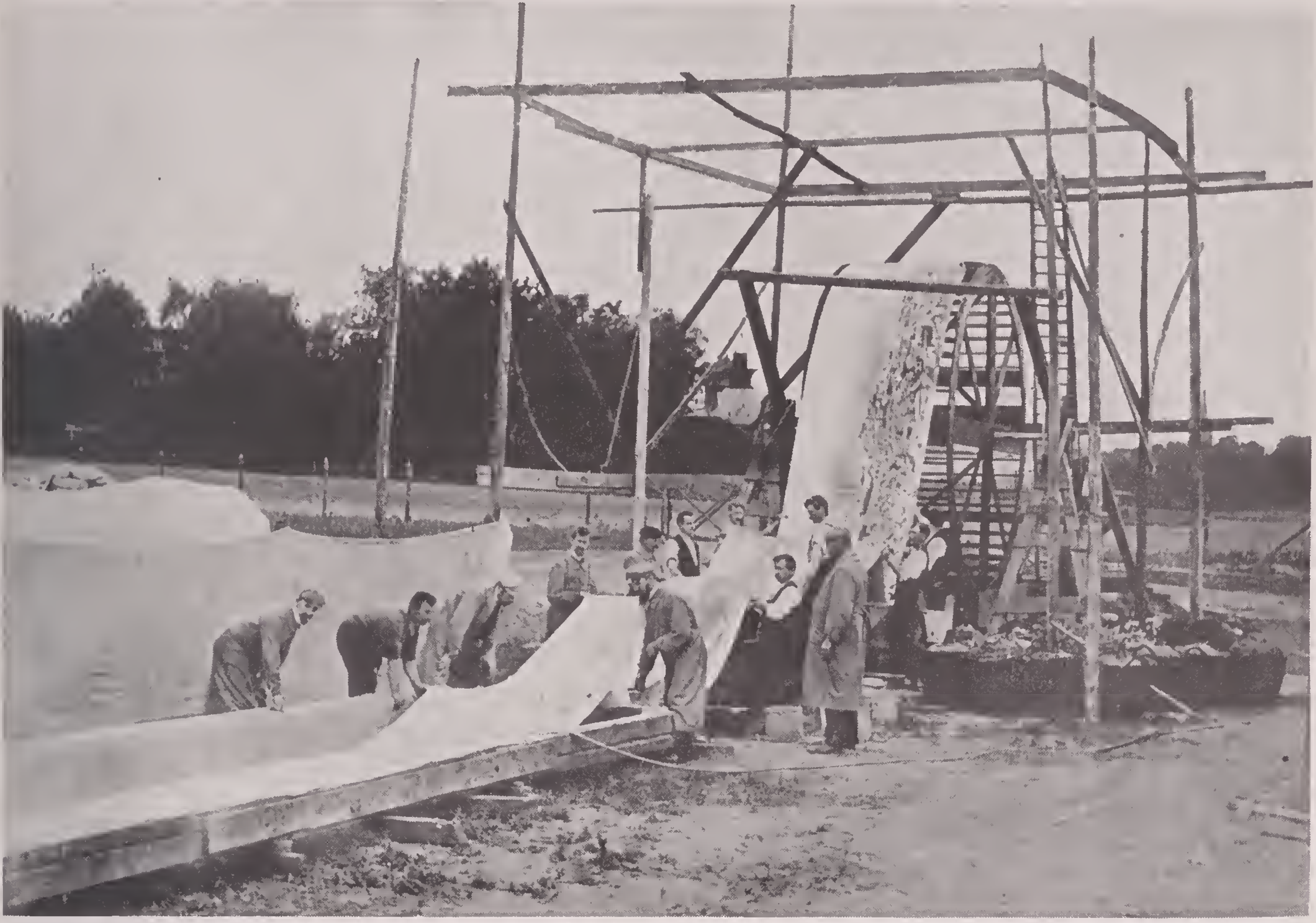
Here the camera has caught a diver at work in shallow water. One of the greatest obstacles to submarine photography is the darkness which prevails when the greater depths are reached.

Cameras vary in size from the tiny instruments which may be concealed in the palm of the hand and which take pictures one inch by three-quarters of an inch in size, to the huge and intricate apparatus used in photographing the distant stars.

The most popular are the film cameras, either of the "box" variety or of the folding type, which closes up like a book. The film, which takes the place of the plate, is simply a long strip of transparent celluloid, coated with the sensitive silver salts. This is wound on a spool, beneath a backing of dark-colored paper which shuts out all the light. The film "cartridge," as it is called, may be loaded in the camera by day light, and a simple winding device draws it across the back of the camera, exposing one section of the film after another behind the lens.

Film cameras cannot, of course, be focused through a ground glass at the back, so they are made either of the small "fixed focus" variety, which require no adjustment, or they have a focusing scale which indicates how the bellows should be extended for different distances. They also have a tiny apparatus called the view-finder, which shows you by a mirror reflection the exact view the camera covers.

THE LONGEST PHOTOGRAPH IN THE WORLD



The photograph the men are handling in this picture is a panoramic view of the Bay of Naples, five feet high and 40 feet long. It was made by taking six consecutive photographs of the bay, and enlarging them upon a continuous strip of sensitive paper, so that each fitted upon the end of the other. The enlarging is done with a machine like a magic lantern, which projects the image of the negative upon the sensitive paper, producing the same effect as a direct print, except that it is on a much larger scale. The print is shown here as it is being unrolled from a great drum for the final washing.

Modern camera lenses take pictures of such extreme accuracy in detail that even the smallest photographs can be greatly enlarged. This is done in very much the same way as a magic lantern or stereopticon throws pictures on a screen (*see* Stereopticon). The enlarged image is thrown for a time on a piece of sensitive paper of the proper size, which is then developed just as in the ordinary printing process.

"Snapshots" and "Time Exposures"

The shutters of nearly all cameras have adjustments regulating the length of the exposure—from a time exposure of one second or more to a snapshot of one one-hundredth of a second, and in certain expensive cameras as short as one three-thousandth of a second. They have also devices called diaphragms for regulating the size of the aperture or hole through which light is admitted. In general, the smaller the hole the sharper will be the details of the picture, but the longer the exposure required, for less light enters through a small than through a large hole. Excellent pictures can be taken at night by the brief flare of a flashlight, created by exploding powdered magnesium, a metal which has the peculiar quality of burning with a brilliant white light. Its action is practically instantaneous.

The action of light rays of various colors on the silver salts used in photography has been of tremendous interest to science. As we know, the white light of the sun is composed of all the colors of the rainbow (*see* Spectrum and Spectroscope) and it has been found that the photographic power of light is due almost entirely to the blue and violet rays contained in it, while the orange and red rays have comparatively little effect. (You remember, the lights in the dark-room were orange or red.) The result of this is that blue objects, like the sky, are photographed as pure white, and red objects as black. To overcome this the gelatin on plates is often dyed certain colors and lens-screens are used which tend to cut down the brilliancy of the blue rays.

In recent years great progress has been made in color-photography, that is, the reproduction of natural colors in the finished photograph. Many methods have been devised, all of them depending upon highly complicated chemical processes.

By a simple attachment called a telephoto lens, magnified photographs of distant objects can be obtained. Pictures of microscopic objects are made with a camera attached to a microscope from which the eye-piece has been removed.

In portrait-making and landscape work, photography has today risen almost to the dignity of a fine art. By the careful "composition" of the picture and by controlling the lighting effects, as well as by "retouching" (altering the negative by drawing in or taking out certain details) and other manipulations of the negative, after it has been developed, photographs are produced which rival the great paintings in artistic effect.

The Amateur Photographer

But for the amateur photographer who simply wants to get good pictures of his friends or of familiar scenes, a little practice and care are alone required for success. Nor is it necessary to have an expensive camera to get good results. There are hundreds of books which explain the practical details of this fascinating pastime, and more than half the fun is to develop and print your own pictures, rather than to content yourself with just "pressing the button" and then carrying the film to the nearest drugstore to be developed. A dark-room can be fitted up at small expense in any large closet, or the work can be done at night in the kitchen with the curtains down; and with a hammer and saw and a pot of glue an enlarging apparatus can be constructed which will give you fine large photographs from your best negatives.

The commonest mistake made by amateurs using small hand cameras is getting improper exposure. The photographs they take on bright summer days are over-exposed, and those taken on dark days are greatly under-exposed. Now the shutters on these small cameras do not usually offer a great range of speeds, so that the amount of light admitted can best be controlled by varying the size of the "stop" or lens aperture—on very bright days, a small stop with the fastest shutter speed, and on dull days the largest stop and the slowest speed. When using any speed slower than $\frac{1}{25}$ of a second, the camera should be rested against some solid object to prevent motion blurring the picture.

The Beginning of Photography

The honor of having produced the first permanent photograph belongs to a Frenchman named Nicephore Niepce, who accomplished this feat in 1827 by coating a silver plate with bitumen and exposing it to the camera image for about eight hours. In 1839, Louis Daguerre perfected the process which produced the famous "daguerrotypes," on which the images of so many prominent in that period are preserved to this day. This consisted of exposing a copper plate coated with silver to the fumes of iodine, forming on the surface the silver salt called silver iodide. Upon exposure in the camera this produced no visible image, but under treatment with vapor of mercury the latent image developed, just as it does on modern plates, except that it was a positive and not a negative image. In 1850 the use of a glass plate coated with collodion to support the silver salts was introduced. In 1871 the present gelatin process was first used.

PHRENOL'OGY. A little more than a century ago Francis Joseph Gall, a German physician, developed into an elaborate system the theory that the functions of the mind are closely connected with certain areas of the brain. He mapped out the brain into 26 definite regions and taught that each of these is the organ of a definite "faculty" or mental or moral disposition. Gall further believed that the relative development of these organs is manifest in the shape of the skull. Thus, by measuring the skull and charting its "bumps" and depressions, one could discover to what degree an individual possesses the various "faculties," and so read his character. "Phrenology" (from the Greek words *phren* meaning "mind," and *logos* meaning "science") was the name given to these teachings. Other writers expanded Gall's system until they had charted 43 so-called "faculties."

For a few years the belief in phrenology had great vogue in Europe and the United States. But today phrenology has fallen into disrepute and is no longer seriously regarded as a legitimate field of scientific knowledge. (*See* Brain.)

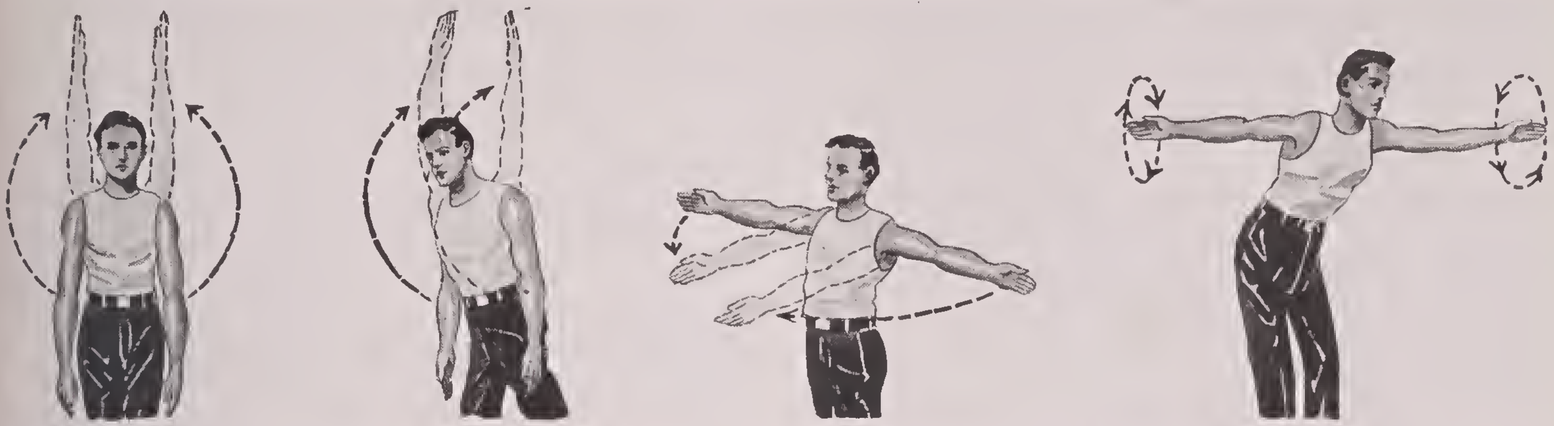
PHYSICAL TRAINING. In pioneer days people maintained their health and strength without a thought of special exercise; but now conditions are changed. Physical training does not attempt to produce trained athletes, for too much exertion is sometimes as dangerous as none; but it does aim to produce and retain normal health for those whose lives are largely sedentary.

Many exercises can be performed anywhere without gymnastic equipment; but pure air is always important. Such exercises should be practiced daily and at regular times if possible, but never within two hours after eating or one-half hour before. The best times are 10 to 12 in the forenoon, or 4 to 6 in the afternoon. Very good results may be obtained by practicing for 15 minutes in the morning before breakfast; and gentle exercises may also be taken with benefit at night before retiring.

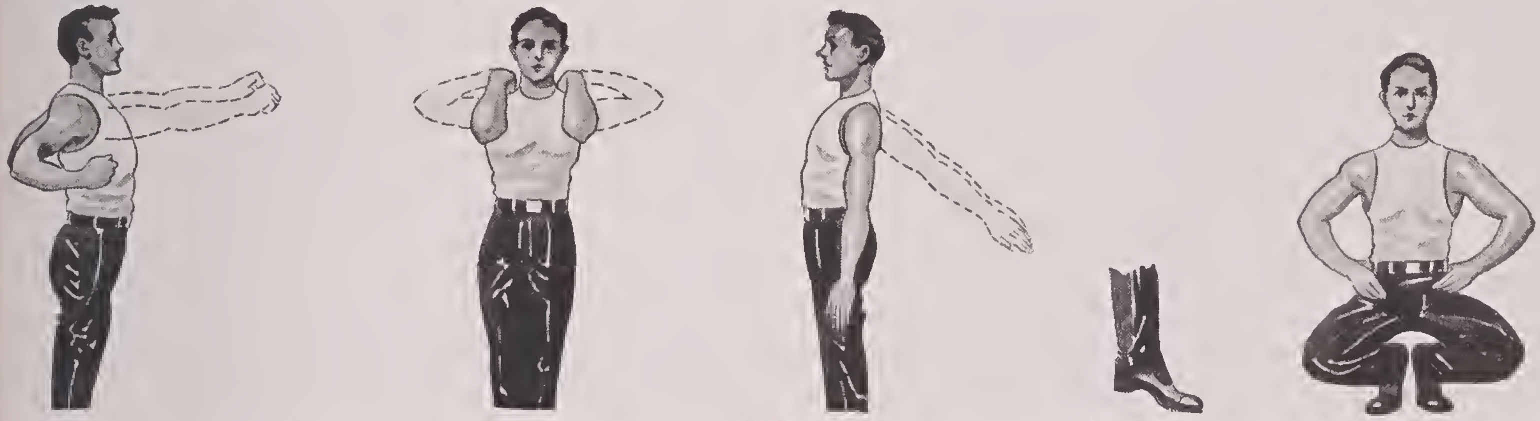
In addition to the "setting-up exercises," described with the accompanying illustrations, there are others, called "gymnastics," which are performed with apparatus. "Light gymnastics" include such exercises as are performed with light pieces of portable apparatus, such as dumb-bells, Indian clubs, wands, hand rings, and balls. "Heavy gymnastics" include those performed with horizontal and parallel bars, ladders, vaulting horses, suspended ropes, poles, rings, and trapeze bars, where the weight of the body is supported and made to move or revolve about the apparatus by aid of the hands or legs. Work with special apparatus is of particular value to persons who, on the advice of a physician, wish to take some form of "corrective gymnastics."

Better than setting-up exercises and gymnastics, however, are games played in the open air (*see* Baseball; Football; Golf; Tennis; etc.), and such outdoor sports as running, bicycling, jumping, pole vaulting, swimming, skating, etc.

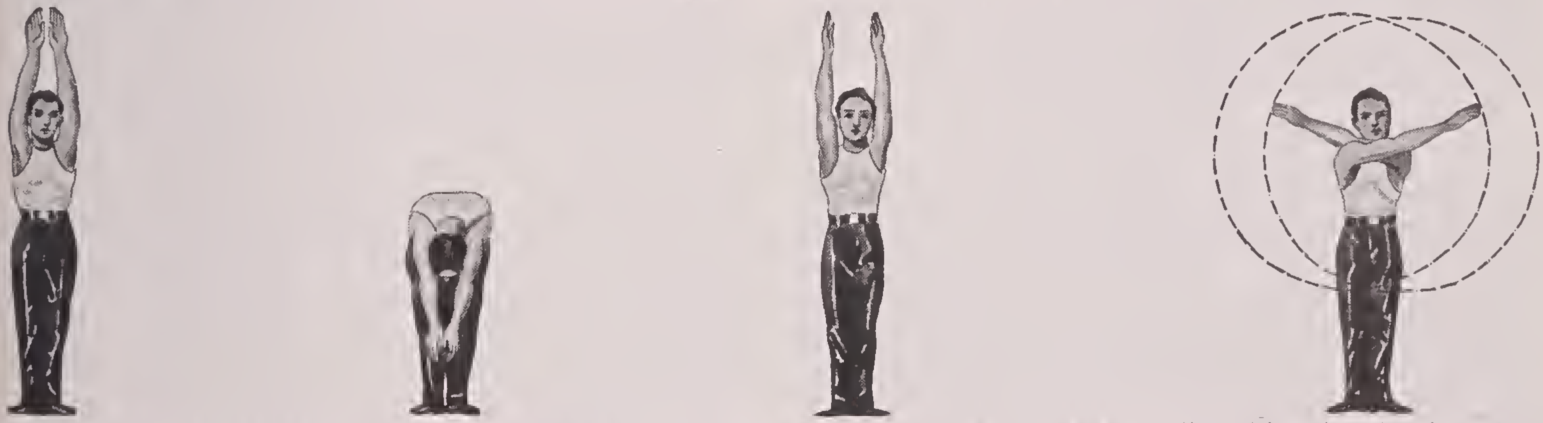
EXERCISES TO KEEP YOU STRONG AND HEALTHY



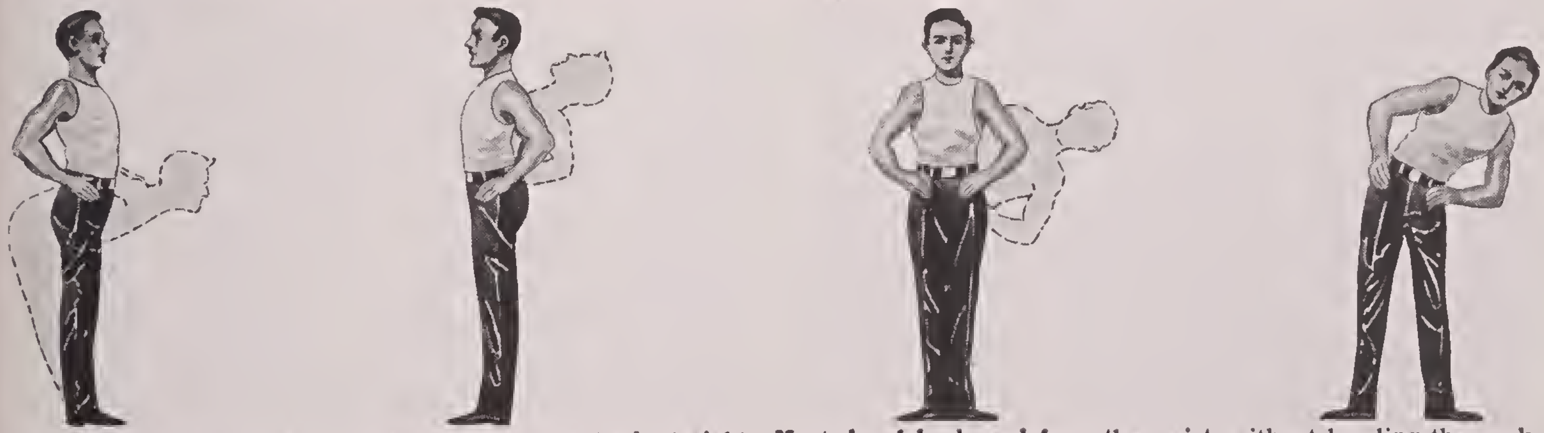
If you follow such setting up exercises as these faithfully, you will supply yourself with capital for the business of life as effectually as if you were putting money in the bank. First, with heels together, arms down, palms in, swing arms sideways to vertical and return; next swing arms forward and upward to vertical; then extend arms horizontally, swing forward and return, with emphasis on backward movement; then start with arms horizontal, back slightly arched, and describe quick circles, up, over, and down. These movements are especially good for the lungs and the muscles of the shoulders.



This set of exercises is designed to develop the muscles of the legs and arms. Beginning with arms bent at side of chest, thrust them forward and return; then, with arms at front horizontally, forearms bent, fingers on shoulders, swing backward to side position. Next, begin with arms flexed, swing downward and forward, bringing arms back, as shown. Next, with hands on hips, rise high on toes, holding shoulders back firmly, and bend the knees as shown.



Beginning with arms at vertical, head fixed between arms, palms forward, bend forward as far as possible without bending the knees, and return. Next, with arms apart and head free, as shown, repeat previous exercise. Then, standing with heels together, swing the arms in circles, downward and inward across the chest, and then reverse the movement. These exercises are particularly good for the muscles of the back and shoulders.



With hands on hips, bend forward, keeping the back straight. Next, bend backward from the waist, without bending the neck. Next bend sidewise to the right and left from the waist. Finally, keeping hands on hips, with feet apart, rotate body at waist. These four exercises are good for developing the muscles of the back and chest, and for keeping healthy the organs of the abdominal region. All of the above exercises are recommended by the Physical Department of the Young Men's Christian Association.

The WONDER-WORKING SCIENCE *of* PHYSICS

How It Has Made Possible Man's Mechanical Triumphs on Land, on Sea, and in the Air—Its Investigations into the Laws of Mechanics, Sound, Heat, Light, and Electricity

PHYSICS. What would our 20th century civilization look like, seen through the eyes of an unspoiled savage, such as Columbus brought back with him to Spain? Imagine our savage returned home and trying to tell his wondering neighbors about his experiences:

"I traveled on land in moving rooms pulled by an iron beast that breathes smoke and fire; and over the sea in vast boats that move without oars or sails. In the cities the pressure of a button in the wall makes night bright as day. By means of a little trumpet on the wall I heard the voice of one who was hundreds of miles away; and by similar means men speak through the air over oceans and continents. I saw a giant bird made of metal, wood, and cloth that carries men into the skies wherever they choose to go; and great metal fish into which you creep and dive beneath the waves of the sea. Carriages without horses move swifter than an antelope. Magic pictures of men that move as you and I do appear at the end of a darkened room and vanish into darkness again. Music and sounds of every sort, including the voices of men and women singing and speaking, are taken captive in magic boxes, and are given forth again at will. One kind of tube brings distant objects near to hand, and another kind makes invisible things visible, and wonderful machines make every kind of goods that the heart can desire."

Such inventions, made possible by the science of physics and its engineering applications, are indeed more astonishing and stupendous than the wildest fairy tales. But all these material marvels are after all not so wonderful as the beautiful fabric of scientific principles back of them. To perceive and understand these principles we must leave the world of fairy tales behind; we must enter another, more absorbingly interesting than any fairy tale, yet one of solid fact.

How Nature Keeps Her House in Order

The world of science is an orderly world, in which like causes always produce like effects. It is a world of things to be exactly measured and counted; number is its cornerstone. It is a world in which the most splendid treasures are found, not at the foot of the rainbow, but in the earth and water and air all about us. Orderly sequence and number are the foundations of the science of physics, and the everyday world about us is the pit from which they are digged.

What is physics? It is the answer to the questions: When does a stone stand and when does it fall? How does the piano or the violin send its music to my ear? How does the fire or the sunshine make us warm? How does the distant landscape print itself as a picture on the retina of my eye? How does the electric current travel along the wire and through the air?

For a long time, the answers to the questions which men asked of Nature were assembled in one huge catch-all, called "Natural History" or "Natural Philosophy." Gradually, as these answers were sorted out and classified, a number of separate sciences—astronomy, geology, botany, zoölogy, and the like—were separated off and defined. Chemistry is the name we now give to the science of matter, its atomic constitution and molecular relations and transformations. Physics is the heir to the "undivided residue" of the estate of Natural Philosophy, and is the mother of a whole family of subsidiary sciences—mechanics, which is the science of motion, mass, force, and the mechanical properties of matter, solid, liquid, and gaseous (*see* Mechanics); acoustics, the science of sound (*see* Sound); the science of heat or thermotics (*see* Heat); optics, the science of light (*see* Light); and electricity and magnetism (*see* Electricity).

Because its field is so wide, physics is hard to define. It is sometimes called "the science of energy, its transformations and its relations to matter." This is easy to remember, but in order to appreciate what energy means, we have to study physics itself. Then, too, we must not forget that "energy, its transformations and its relations to matter," run through the subject-matter of all science.

Some of the Great Truths of a Great Science

All science, indeed, depends and draws upon the laws of physics. Its first hypothesis—that Nature is not wayward and capricious as she seems to the untrained eye, but works in regular ways, which men call "laws," and which can be discovered by patient study of her operations—is the very foundation of all scientific thought. The constancy of Nature, dimly apprehended by the savage who sees day succeed night and harvest follow seedtime, finds its first magnificent all-embracing affirmation in the declaration that the "law of gravitation" (*see* Gravitation) runs throughout the universe. Change figures as they may in the wild whirling dance, not an atom is lost—every one is immortal—according to the principle of the "indestructibility of matter" or the "conservation of mass." Tiny pebble or vast sun or planet, once set going, would travel unresting on its straight path forever, unless deflected by some other force, according to the principle of the "conservation of momentum." Just as matter can be neither destroyed nor created, so energy is invariable in amount, according to the principle of the "conservation of energy," though it can be subtracted from a pound of coal, for instance, and added to a quart of water, as when the coal is burned to boil the water. The process does not reverse itself—the energy will never run back from the water to rebuild the coal out of its ashes and smoke. The transformations of energy are like the irrevocable running down of a clock, according to the principle of the "dissipation of useful energy."

These are some of the principles of physics which, like towering mountains, furnish guiding landmarks to the whole realm of science.

Great Discoveries in Physics in Recent Years

The scope of physics has been enormously extended within very recent years by the discovery of new fields and new principles, and the construction of highly important new theories which can be barely mentioned here. Among these are the discovery of the propagation of energy through space as electromagnetic wave motion (Hertzian waves), which makes wireless telegraphy possible, and the discovery of X-rays, and of radium and other radio-active substances. Of slighter theoretical but much practical importance was the discovery, which made aviation possible, that in air, unlike water, the amount of force required to sustain a plane decreases with increase of the velocity. The electron theory of electricity is closely connected with the new theory of matter (*see* Atoms and Electrons), which pictures the atom, hitherto supposed indivisible, as something like a miniature solar system. The most important recent theory, however, is the hypothesis, which has been called "the fulcrum of modern physics," of that mysterious substance the ether (*see* Ether), stretching away in the vast interstellar spaces and permeating the structure of earthly solids like steel and glass as the air fills the spaces in a grove of trees. So tremendously important is this concept of the ether that Sir Oliver Lodge defines physics as the science of "matter in motion, ether under strain." The former, he says, represents kinetic energy, the latter potential energy, and all the activities of the material universe represent alternations from one of these forms of energy to the other.

Physics, one may say, is as old as the human race; its history began when men first noticed that tossed pebbles fall to the ground and that water boils over a fire. Yet other sciences, such as mathematics, reached a high degree of development among the ancients, while the science of physics, in spite of isolated discoveries—particularly the important achievements of Archimedes in mechanics—remained largely an unknown realm. Roger Bacon in the 13th century foreshadowed the experimental science, which Galileo largely founded and to which Newton gave the first broad philosophic basis. Torricelli and Boyle and Mariotte were among the first to establish the properties of the atmosphere and of gases. Huyghens laid the foundations of the science of physical optics. The names of many of those who, following William Gilbert, Franklin, and Cavendish, worked out the first concepts of magnetism and electricity, and of Black, Davy, and Joule on the nature of heat, are embedded in the terminology of the science itself. These and many others prepared the way for the wonderful work done in the 19th and 20th centuries by hosts of scientific workers, of whom it is possible to mention only a few of the most eminent—such as Faraday, Ampère, Helmholtz, Henry, Gibbs, Maxwell, Hertz, Roentgen, Kelvin, J. J. Thomson, Rutherford, Michelson, Einstein, and Sir Oliver Lodge.

READING EARTH'S *Fortunes in Its* FACE

The Age-Long Drama of the World's Life which is Still Being Written on Rocks and the Surface of the Soil by Wind and Rain, Frost and Snow, by Flowing Rivers and Glaciers, and by the Rise and Fall of the Earth's Crust

PHYSIOGRAPHY. Between physiography, geography, and geology there is no sharp line of division. As the term is now commonly used, physiography is the science that deals with the ever changing surface of the earth and with the relation of air and water to it. It is therefore virtually identical with the study of physical geography, with special emphasis on how the physical features of the earth originated. In this aspect it is closely related to geology. Indeed it has been aptly called "the latest chapter in geology."

The atmosphere is as much a part of the earth as are the rocks. The study of the atmosphere is called "meteorology," but physiography, even in its narrowest meaning, includes the consideration of the atmospheric forces and processes which have shaped the present surface of the land. This includes the movements of the air (winds), the moisture of the air, especially precipitation, the changes of temperature and the chemical changes effected, directly or indirectly, through the influence of the atmosphere (*see* Air; Climate). While meteorology includes the study of atmospheric movements as such, physiography in its narrower sense includes only the effects of those movements on that part of the earth which lies below the atmosphere. The ocean, likewise, is a part of the earth. The science which deals with the ocean as such is "oceanography," but the consideration of the ocean as a part of the earth falls within the province of geology, while a consideration of the effects of oceanic activities which modify the surface of the solid part of the earth falls within the scope of physiography. Thus the effects of rivers, waves, currents, etc., on the configuration of the solid part of the earth fall within the province of physiography.

All processes that work on the earth's surface have been grouped into three classes: "diastrophism," "vulcanism," and "gradation." Diastrophism includes the up-and-down movements of the earth's crust, movements which, however gentle and slow, are continually in progress. Vulcanism includes all processes connected with volcanoes (*see* Volcanoes). Gradation includes all processes by which material is shifted from one point on the earth's surface to another. The centers of diastrophic and volcanic activity are beneath the surface. The processes of gradation are in operation on the surface, chiefly at the plane of contact between atmosphere and land and between water and the solid part of the earth beneath it. The transfer of material in gradation is usually from higher to lower levels. Thus rivers carry débris from land to sea. They *degrade* the land, and the material, deposited in the sea, *aggrades* its bottom. Glaciers likewise carry material from higher to lower levels. They degrade the places where they gather débris, and aggrade the places where they leave it. The degradation of one place generally involves the aggradation of another. The sand and dust blown by the wind constitute a partial exception to the rule that the materials shifted about on the earth's surface are transferred from higher to lower levels, for they often pile up to form hills.

Continents, Islands, and Oceans

The greatest features of the earth's crust are the elevations known as continents, in contrast with the depressions known as ocean basins. The sharp, topographic division-line between continents and ocean basins does not correspond with the borders of the continental land areas. For a distance about the continental lands the water is very shallow. There is then a sudden descent of the bottom to much greater depths. The area beneath the shallow water is the *continental shelf*. Its outer border usually is about 100 fathoms below the level of the sea. From the physiographic point of view the outer edge of the continental shelf is the border of the continent.

While the explanation of the existence of continents and ocean basins is a problem of physiography, it is an unsolved problem. The continents have sometimes been looked on as uplifted portions of the earth's crust; but it would perhaps be quite as near the truth to consider the ocean basins as depressed portions. It, however, is far from certain that the surface of the solid part of the earth was ever regular. If the continents were lifted or if they were left up as the result of the sinking of the ocean basins, they are the result of diastrophism. If this was not their origin, they probably came into existence when the earth was in process of formation, whatever that process was. Smaller land masses, that is, islands, have originated in various ways. Some are diastrophic, some are gradational, and many are volcanic.

Peninsulas and Capes, Gulfs and Bays

It is the province of physiography to define, classify, and explain the origin of all sorts of horizontal irregularities of land areas. Among the horizontal irregularities of the land are peninsuias, capes, etc.—land masses projecting into the sea. Among the horizontal irregularities of the ocean are gulfs, bays, etc.—or bodies of water projecting into the land. The sizes, positions, and shapes of these irregularities are readily expressed on maps. Not so their origin. They have, indeed, originated in many different ways. For example, the uplift of an area of sea-bottom along a line at right angles to the coast of a continent would give rise to a peninsula, like Florida. The uplift of two such peninsulas near each other might leave a gulf or bay between them. Again, the sinking of a coast allows the sea to invade the lower ends of the river valleys, forming bays, as Delaware and Chesapeake bays. When the sea converts the lower ends of adjacent valleys into bays, it leaves a peninsula between. Peninsulas and bays formed in this way are the results of diastrophism. Small peninsulas or capes, like Cape May, may be built by deposits of sand and gravel made by waves and shore currents. They are the result of gradation—in this case, of aggradation. Glaciers moving down valleys to the sea, as in high latitudes, may gouge out the lower ends of the valleys through which they pass, cutting them down far below sea level. When the ice melts, deep, narrow bays or fiords, like those of Greenland, Norway, or Alaska, are the result. Such bays are a result of gradation; in this case, of degradation. Volcanic activity on a coast line may result in extending the land, making a cape.

Relief Features of the First Order

Physiography has also to do with the vertical configuration of the land. The great relief types are three: plains, plateaus, and mountains.

Plains are relatively low areas of considerable extent, with surfaces which are not notably rough. *Plateaus* are similar tracts of greater altitude, which stand up more or less prominently above their surroundings on one or more sides. *Mountains* usually have less areal extent, and stand up more conspicuously above their surroundings. They generally have somewhat narrow summits and steep slopes.

As topographic features, plateaus and plains may be said to differ from each other chiefly in elevation; yet there is no specific elevation above which land may not rise and yet remain a plain. Formerly, plains were often defined as lands below 1,000 feet in elevation; but this arbitrary definition has no warrant in nature or in usage. The fact is that some plains grade into plateaus and that there is no sharp line of demarkation or basis of separation which is uniformly applicable. An extensive tract of land 500 feet above the sea would probably be called a plain if it were surrounded or nearly surrounded by higher land, or if it were bordered by notably high land on one side and descended gradually to much lower levels on others. On the other hand, a tract of land 500 feet above the sea would probably be called a plateau if it were bordered on one or more sides by a tract of considerable extent which had an elevation of but 100 or 200 feet, particularly if the descent to the lower level were abrupt. Extensive areas 1,000 feet or

LAND FORMATIONS AND THEIR CAUSES

FIORDS
When the coast sinks, former mountain canyons become fiords.

"ATOLL" ISLANDS
They are built up by coral polyps in cup-shaped form on rocky foundations.

"BAD LANDS"
Strange forms cut out by violent rain storms in semi-arid regions.

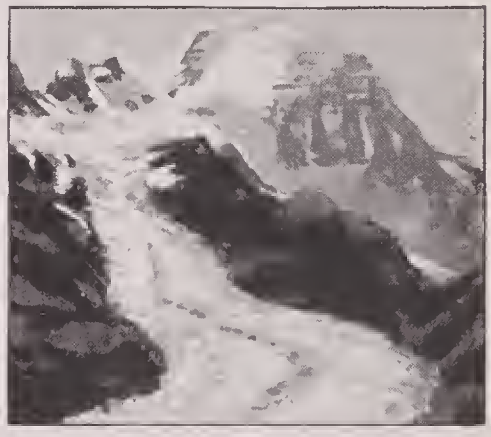
V-SHAPED VALLEYS
Such valleys are "young" with their sides still unworn by the weather.

BROAD FLAT VALLEYS
Such valleys are "old," filled with debris washed down from their sides.

RAPIDS AND WATERFALLS
Usually caused by the wearing away of softer parts of the river bed.

RUGGED MOUNTAINS
These are still "young" and comparatively unworn by wind, rain, and frost.

ROLLING MOUNTAINS
Their rounded angles have been smoothed by ages of wear.



GLACIERS
They occur where moisture is constantly supplied to a frigid slope.

GEYSERS
They arise when water is turned to steam by underground fires.

VOLCANOES
Outpourings of lava and ashes gradually build up cone-shaped peaks.

SEA CLIFFS
The pounding surf erodes the weaker rock, leaving the coast irregular.

even considerably more above the sea would probably be called plains rather than plateaus if they were surrounded or largely surrounded by higher lands, while they would be called plateaus if they stood up distinctly above their surroundings. Thus parts of the *plains* of the Mississippi basin are higher than parts of the Piedmont *plateau* lying east of the Appalachian Mountains.

Some plains originated by the elevation of shallow sea-bottom enough to convert it into land; others are the result of the building up of sea-bottom slightly above the level of the sea; others are the result of the wearing down of mountains and plateaus; and still others owe their origin to the combined action of the processes just mentioned. Subsequent to the origin of plains, their surfaces have been modified by rain, rivers, winds, glaciers, etc.

The Story of the Plains

Coastal plains, some wide, some narrow, occur in many places along the borders of continents and islands. Many *interior plains*, like the Great Plains of North America, are often much higher than coastal plains. Most of the people of the earth live on plains, because they are more extensive than plateaus or mountains, their climate is more favorable, they have more land fit for cultivation, their rivers are more commonly navigable, and the building of roads, railways, and canals is easier. Coastal plains are likely to have flat straight coasts with few harbors. A notable exception is the Atlantic Coastal Plain, many parts of which have been lowered so that the ocean has advanced into the mouths of the rivers, thus making many good harbors. Such a coast is called a "drowned coast."

Some interior plains are the beds of lakes which have dried up; these are called *lacustrine* plains. The rich wheat lands in the valley of the Red River of the North, in North Dakota, Minnesota, and Manitoba, are the bed of an immense lake, called Lake Agassiz by geologists, which vanished ages ago.

Various kinds of plains are distinguished by special names in various parts of the world. The plains surrounding the Arctic Ocean, where scanty and dwarf vegetation grows on land which is perennially frozen, except for a few inches at the surface in summer, are called *tundras.* Inland in all the continents are vast treeless or almost treeless areas, where the prevailing vegetation is grass, which grows with incredible rapidity during the short summer months. Such plains are called *steppes* in Europe and Asia, *prairies* in North America, *llanos* in Venezuela, *pampas* in the Argentine Republic, *downs* in Australia, and *savannas* in various tropical regions. Many of these treeless plains are without forests because of too scanty rainfall; but trees flourish on many of them if they are cared for while very young.

Plateaus originated in various ways. Some have probably been elevated above their surroundings; in other cases the surrounding land may have sunk away from them; others have been built up by lava flows. Many of them have a scanty rainfall because the high bordering mountains cut off the rain-bearing winds. Most high plateaus are too cold to be favorable to agriculture, and so have a scanty population.

Mountains are the most striking and awe-inspiring features of the earth. Where they rise abruptly to great heights every variety of climate may be found within the range of a day's travel, as in the Andes of South America. No natural feature more profoundly influences human life. They present formidable barriers to travel, and so isolate one community from another. While they have sheltered their inhabitants from invasion and have often become refuges for persecuted peoples, they have also hindered the spread of commerce, of thought, and of civilization. Often they are the backwaters of the stream of life, where the stragglers of humanity live on in ignorance and poverty. Except in fertile valleys, they are not favorable to human life, and few important cities are found in them other than along tourist routes or in mining areas. Mountains also deeply influence the life of neighboring regions, deflecting winds or robbing them of their rain so that the lands under their lee are often desert or semi-arid.

Mountains are not more sharply defined than plains and plateaus. The term mountain implies notable elevation, but a mountain is not necessarily higher than a plateau. Thus the plateau of Tibet is much higher than any part of the Appalachian mountain system. The term mountain implies: (1) a considerable elevation above surroundings, and (2) crests of limited area. An isolated elevation 1,000 feet above its surroundings, rising abruptly above a low flat plain, would doubtless be called a mountain, though an elevation of the same height with gentler slopes on a rolling plateau might not be.

Mountains have originated in various ways: by diastrophism, as in the case of mountains formed by the upfolding of the superficial strata of the earth's crust, or by the up-thrust of blocks of the earth's crust; by volcanoes, as in the case of volcanic peaks; and by gradation. Like plains and plateaus, mountains are modified by wind and water and air after they are formed.

Minor Relief Features

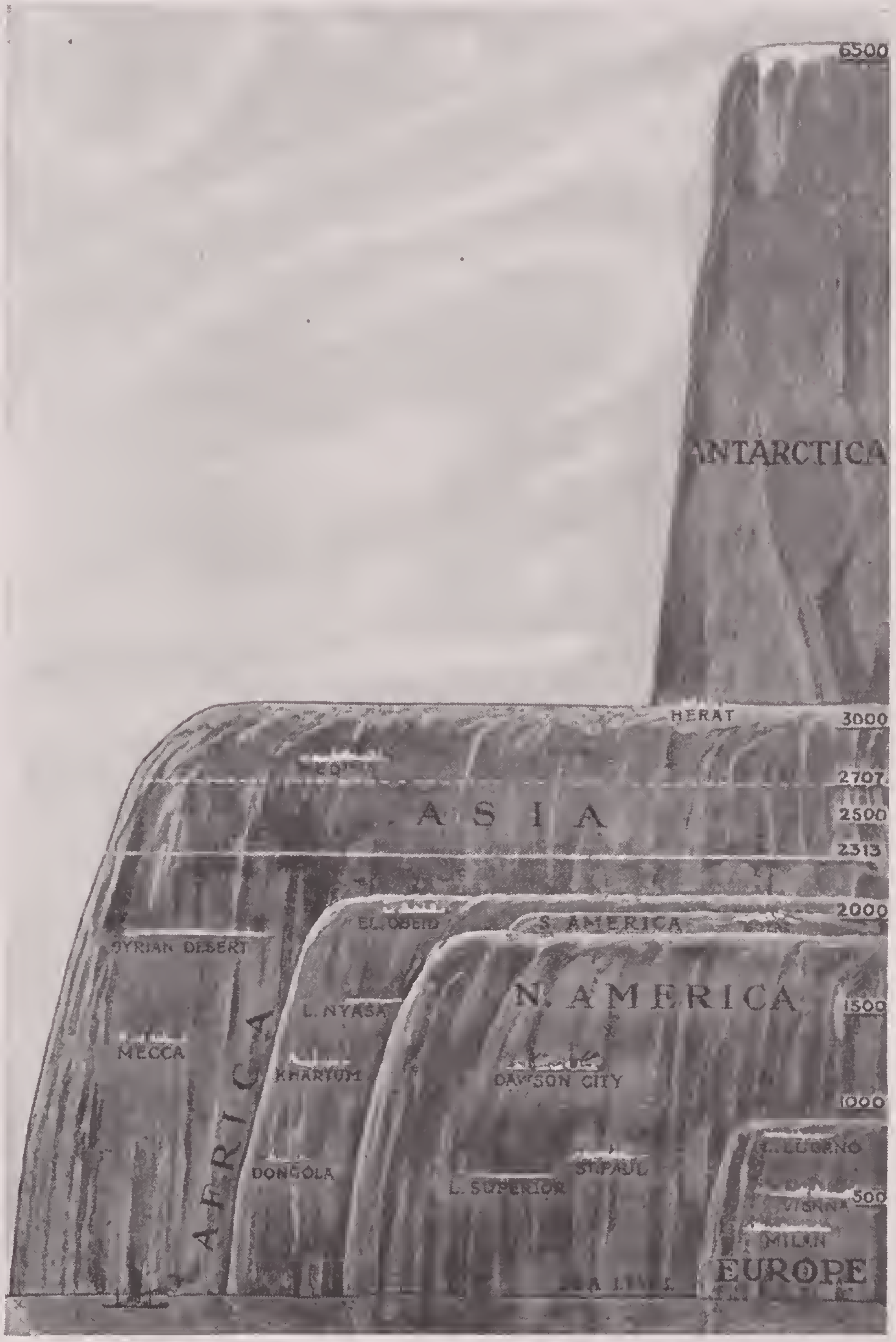
The great relief forms—plains, plateaus, and mountains—are affected by numerous smaller relief features. Thus, a plain or a plateau may be affected by depressions (valleys) cut out by streams. Between the valleys remain elevations. If the elevations are long and narrow, they are *ridges:* if short, *hills.* The valleys are *made:* the ridges and hills are *left.* As a result of the excavation of valleys, plains may be far from flat. Generally speaking, the valleys are deep in proportion as the land is high. The valleys of plateaus, on the whole, are deeper than those of plains, and the ridges and hills between them are therefore higher. If the ridges or hills be very high, they may be called mountains. For example, the Catskills are simply the big hills left in the erosion or wearing away of the plateau which once existed where the mountains now are. The depressions between the mountainous hills have been worn out by running water. It is thus that mountains originate as the result of gradational processes operating on plateaus. Special names are given to special forms of hills or mountains, developed by erosion. Here belong *buttes*, large, flat-topped high hills developed by erosion in arid regions; *mesas*, which are more extensive remnants of worn down plateaus, etc.

Valleys are constantly being widened. Young valleys are narrow, with steep V-shaped slopes. Old valleys are wide, with gentle slopes. This widening is the result of many causes. Sometimes a stream flows against one side of its channel with such force as to undercut the slope above. The rainwater flowing down the sides carries soil with it, and thus wears down the slope. The soil also tends to slip down of its own weight, especially when it is wet. In some river valleys, however, which are called *gorges* if they are small and *canyons* if they are larger, the process of deepening has outstripped the process of widening. This happens at considerable heights where streams have great velocity, cutting their way through rock which wears away slowly, and where there is little rainfall to help wear down the slopes, as in the Grand Canyon of the Colorado (*see* Canyon).

In addition to its work of eroding or wearing away the land, running water also makes changes in the earth's surface by depositing part of the load of sediment it carries. This usually occurs when its current is checked, as at the base of a steep slope. Such deposits are called *alluvial* deposits. Along valley bottoms, narrow alluvial plains are often developed, many of them of great fertility. In such plains, natural *levees* often are developed. In time of flood the current in the main channel is swift, but as the water spreads beyond its channel over the neighboring parts of the plain, its velocity is suddenly checked, with the result that it deposits part of its load in the form of low ridges on either side of the channel. In this way the Mississippi, the Indus, and other great rivers have in places raised their level many feet above that of the plain through which they flow. Where a swift stream flows into the sea, its current is checked promptly, and its sediment is deposited, making *deltas*, if it is not washed away by the waves and currents. The growth of deltas has made a great amount of valuable and fertile land, such as is found at the mouths of the Mississippi, Colorado, Amazon, Nile, Ganges, and other rivers. The growth of deltas works great changes in coast lines, the Rhone, for example, having advanced its delta about 15 miles into the sea in as many centuries.

Another topographic form is the *basin*. Basins, like most topographic types, are of various sorts. Some are large, some small. They may affect the surfaces of plains or of plateaus, or they may occur among mountains. Some have outlets, and some have not. Those which have not may give rise to lakes, ponds, etc. Ponds and lakes may have outlets, but below the level of the outlet is a basin which

HOW THE CONTINENTS COMPARE



This drawing shows how the continents would compare in bulk and average height, if they were all grouped together in solid masses of similar shape. Asia prevails in bulk, but the estimates of the Antarctic continent give it by far the greatest average altitude. The dotted line shows the average height of all the Earth's land masses including the Antarctic Continent, and the white line the average height without the Antarctic. The altitude of some important regions and cities is indicated by the names in small type.

has no outlet, else there would be no lake or pond. Other so-called basins are inclosed on three sides and open on the fourth, or at least at some one point. It is customary to speak of the great depression between the Appalachian Mountains on the east, the Rockies on the west, and the height of land on the north as the Mississippi basin, although it is by no means completely inclosed by high land; but it is only a "drainage basin," and not a basin in the proper sense of the term.

Configuration of the Sea-Bottom

The configuration of the sea-bottom also falls within the province of physiography. While the sea-bottom is less familiar than the land, its general features are known. It is known, for example, that there are great areas of the sea-bottom elevated above their surroundings. Such areas are comparable, in some sense, to the plateaus on land. There are great areas where the ocean-bed is depressed, relatively to the areas just referred to. Such areas are comparable to the plains of the land. There are other depressions in the ocean-bed, more limited in area, which are comparable to basins on the land, though some of them are much larger, both in area and depth, than the inclosed basins on the land. Many parts of the ocean-basin have been affected by vulcanism. Volcanic peaks are, on the whole, more notable features of the ocean-bottom than of the land. In its fundamental features or features of the first order, therefore, the ocean-bed has some likeness to the land. But gradational agencies, especially degradational agencies, are not operative on the ocean-bottom, except in very shallow water. Since it is degradational agencies which produce the most notable secondary features of land surfaces, and since these agencies are little operative in the sea, the sea-bottom, in general, is without the hills, the ridges, the mountain peaks due to erosion, the valleys, valley plains, and terraces which abound on the land. These physiographic forms sometimes are found on the sea-bottom, and the areas where they occur are thought to have been land at one time, though now submerged. On the other hand, the shallow sea-bottom is affected by bars, reefs, etc., built by waves and shore-currents, by soil carried down to sea by rivers, and by coral polyps. Reefs are not formed on land, and are found there only when an area of sea-bottom is elevated to the estate of land.

The COMPLEX MECHANISM *of the* HUMAN BODY

A Glance at the Science that Tells of the Parts of the Engine of Life and Their Functions—The Many Mysteries Still to be Explained

PHYSIOL'OGY. The body of the average man weighing 150 pounds contains the equivalent of 100 dozen eggs, enough iron to make 4 tenpenny nails, fat contents sufficient for 75 candles and a good-sized piece of soap, phosphate for 8,064 boxes of matches, enough hydrogen (in combination) to fill a balloon and carry him above the clouds, and besides all this, 10 gallons of water, 6 teaspoonfuls of salt, and a bowl of sugar. This gives us some idea of what we may call the *chemistry* of the human body. Its structure and its way of working are equally wonderful.

Now if you are going to run an automobile or a motorcycle you want to know not only what the different parts are, and of what they are made, but you must also learn how each part works or "functions," and what its purpose or use is in operating the machine. It is the same when we study an animal or a plant. The study of its *anatomy* (*see* Anatomy) will tell us the way it is built and even its minute structure, but it is the study of its *physiology* that tells us how each part functions when the animal is alive. And this is not quite so easily learned as the former. For when we attempt to separate the parts that we may examine and study them, we are likely to kill the animal or plant, and the very part which we wanted to examine quits work, so that we have defeated the end for which we strove.

For many centuries this was the great stumbling-block to scientists and physicians. There is still much that is mysterious in human physiology, for even today there are many activities of our bodies of which we know very little. But we are learning!

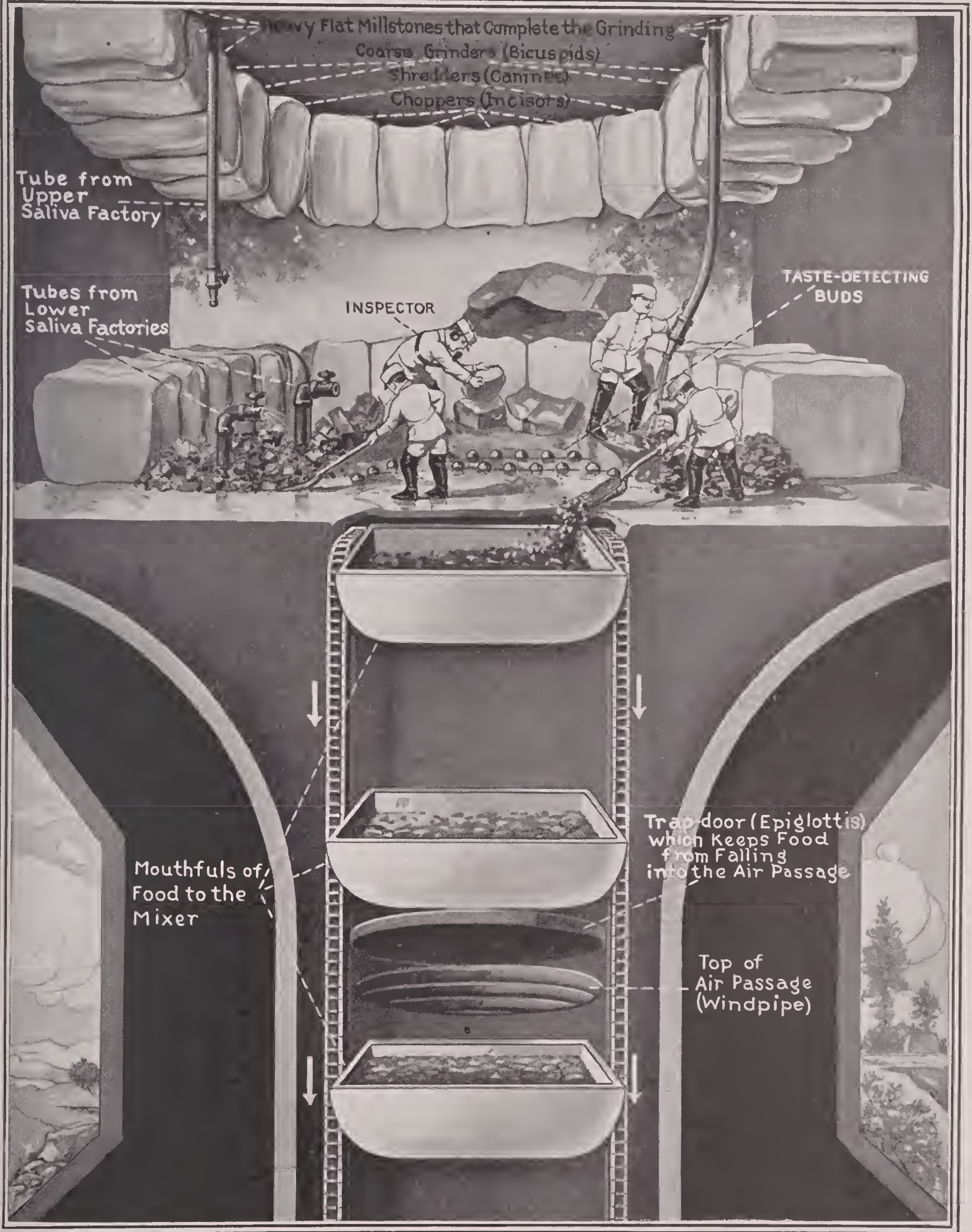
In the early days, "humors" and "spirits" were supposed to control certain functions, and anatomy, physiology, and medicine were a jumbled mass of facts and fancies. Then men of deep thought and earnest work began to make independent investigations. The microscope was invented, and they could actually *see* the blood flowing through the capillaries from the arteries to the veins, when the animal was alive, and other activities as well. Since then our knowledge has constantly deepened and broadened.

The Four Groups of Organs

As a result of experiment and study we have learned that, as regards its functions, every human or animal organ falls naturally into one of four great groups.

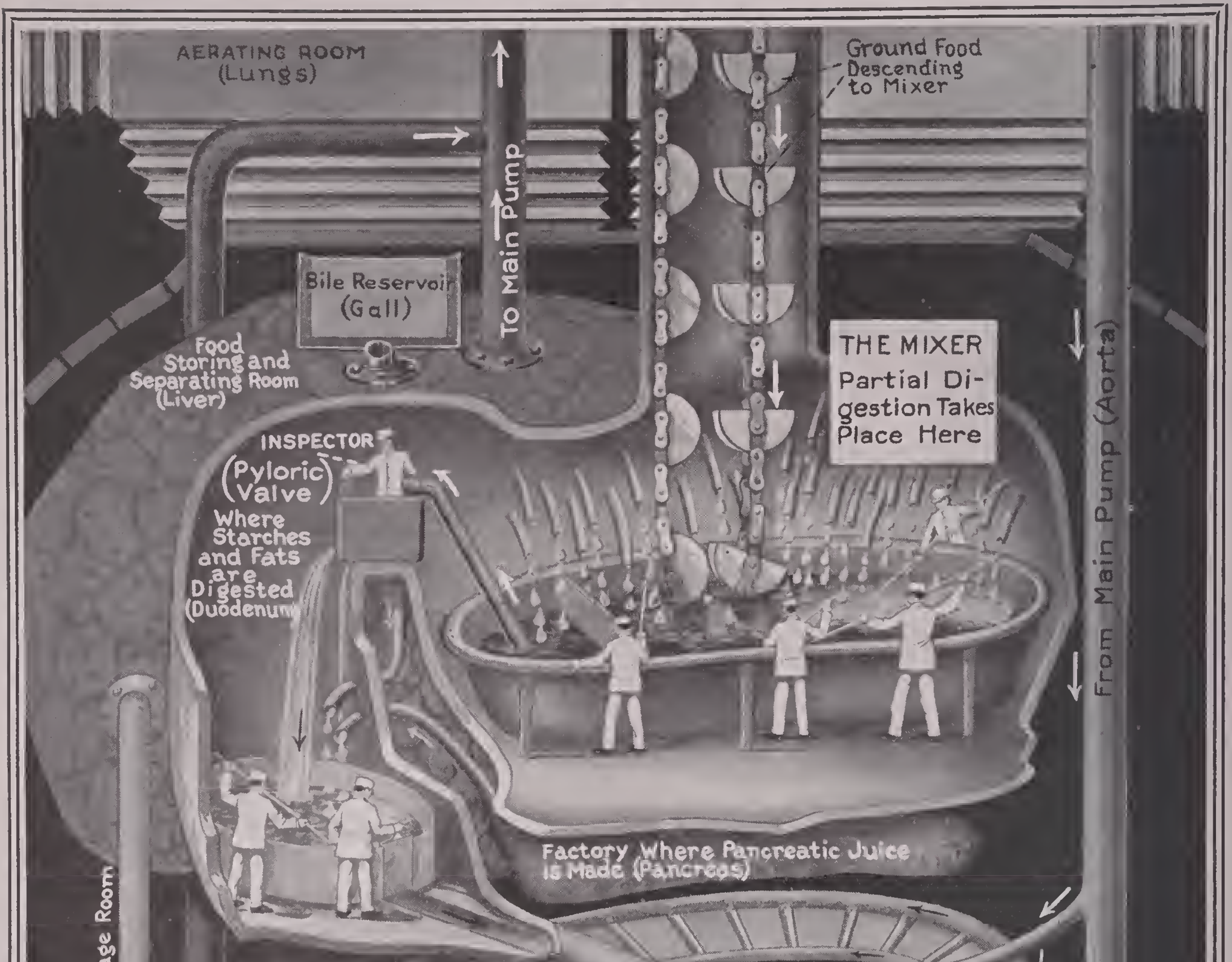
First, there are those organs whose function deals with *nutrition*—that is, with feeding the different organs of the body and disposing of its waste products. The blood in the animal supplies food to the different parts of the body; the heart pumps the blood; the stomach and digestive system prepare the food so that it may be taken up by the blood; the liver, pancreas, etc., help in the work of digestion; the kidneys aid in throwing off waste products; the lungs take from the air the oxygen which is needed by every living cell of the body, and throw off the poisonous carbon dioxide which is made in the various chemical changes that

OUR BODY MACHINERY—IN THE GRINDING MILL


Heavy Flat Millstones that Complete the Grinding
Coarse Grinders (Bicuspids)
Shredders (Canines)
Choppers (Incisors)
Tube from Upper Saliva Factory
Tubes from Lower Saliva Factories
INSPECTOR
TASTE-DETECTING BUDS
Mouthfuls of Food to the Mixer
Trap-door (Epiglottis) which Keeps Food from Falling into the Air Passage
Top of Air Passage (Windpipe)

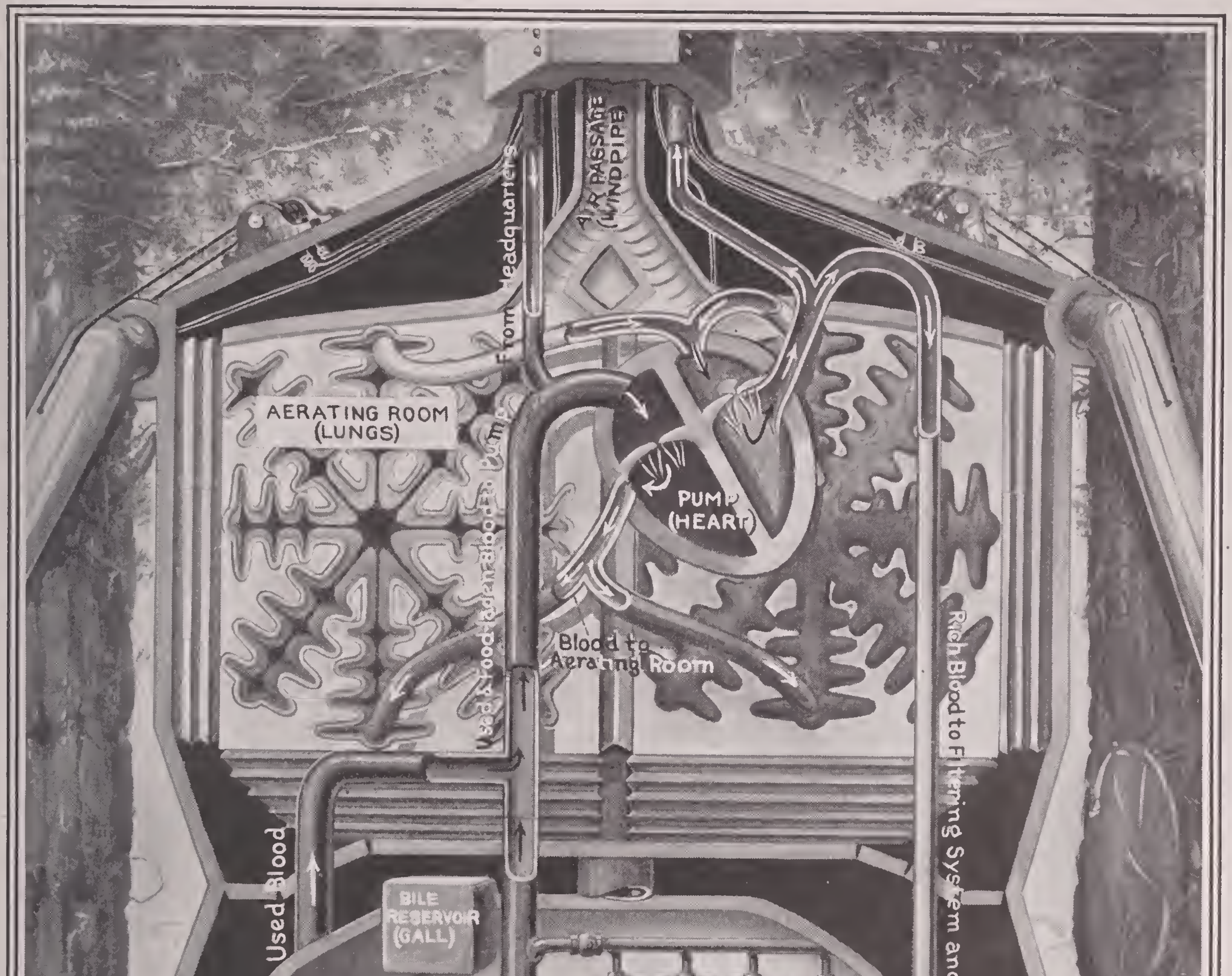
Just as locomotives turn their fuel (coal and water) into a means (steam) for applying energy to their working parts, so does our body machine have a means for turning its fuel (food) into blood for its working parts. This picture shows the grinding mill, where fuel is received and worked into shape for the succeeding processes. The first thing is inspection, just as a grain inspector examines grain at a flour mill, to see if it comes up to grade. This the mouth inspectors do by tasting it. That's what the taste buds are for. Having passed the inspectors, the food is ready to be ground up. All the food is first ground coarsely, and then finer and finer, just as in the case of wheat in a flour mill. And all this time those tubes are pouring in saliva, which softens the food and partially digests the starches. When the grinding and mixing are finished, mouthfuls of food are started on their way to the mixing room. A special trap door (epiglottis) is provided, which shuts when food comes down, and keeps it from entering the air passage.

OUR BODY MACHINERY—THE MIXING ROOM


AERATING ROOM (Lungs)
To Main Pump
Ground Food Descending to Mixer
Bile Reservoir (Gall)
Food Storing and Separating Room (Liver)
THE MIXER Partial Digestion Takes Place Here
From Main Pump (Aorta)
INSPECTOR (Pyloric Valve)
Where Starches and Fats are Digested (Duodenum)
Factory Where Pancreatic Juice is Made (Pancreas)
Food-laden Blood to Separating & Storage Room
Pipe from Lower Part of Works (Vena Cava)
Filtering System Where Food Enters Blood (Intestines)
Pipe to Filtered Food Supply
WASTE PIPE

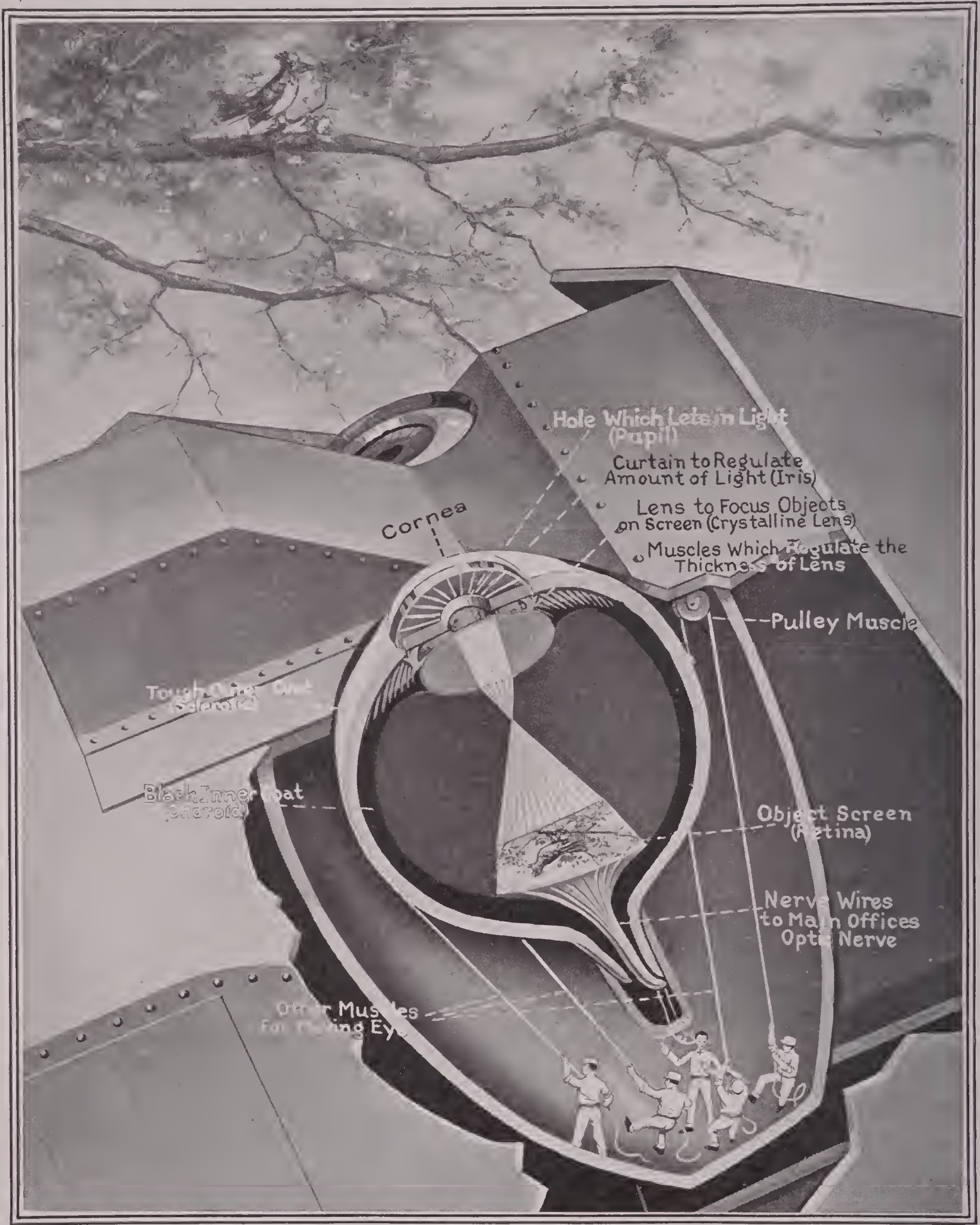
Here we are in the mixing room itself, the stomach. The liquid juice which you see pouring out from all sides is mixed with the food, and digests the albuminates—that is, the meat, eggs, cheese, and similar substances. See that little man standing at the passageway between the stomach and the duodenum? He's the inspector, and any food that has not been properly mixed with the gastric juice he sends back for further treatment. The starches and fats, although still undigested, are allowed to pass by because they are to be digested in the duodenum. The digesting is done by the bile and the pancreatic juices you see dripping from those two pipes, and the intestinal juices. Out of the duodenum the food passes into the intestines, represented by that long coiled tube, and as it passes along, the useful part of it is taken out and emptied into the blood, while the waste is disposed of through the waste pipe. Back of the stomach is the food and separating room (the liver) in which wonderful things are going on, as we shall see in the next picture.

PURIFYING, SEPARATING, AND STORAGE ROOMS



We have just had a glimpse of the outside of that wonder-working department of the human system known as the liver. We saw entering into this the food-laden blood from the intestines. Here we can see plainly what happens to this blood after it enters the liver. Here the biliary secretion is separated from the blood, and made into bile. The gall bladder is a reservoir for the accumulation of bile, when its flow into the intestines is, for any reason, interrupted. The liver also makes many important chemical changes in the food substances. The pipe leading from the separating rooms empties into the one carrying the used blood from the lower parts of the body, and the two streams, thus united, flow to the heart. There the pumps force the blood to both sides of the aërating room (lungs), whose spreading branches expose it to the purifying air. The purified blood, enriched by the food supply, enters the left side of the heart, and is distributed over the body by the action of this pump.

THE LITTLE CAMERAS THROUGH WHICH WE SEE


Hole Which Lets in Light (Pupil)
Curtain to Regulate Amount of Light (Iris)
Cornea
Lens to Focus Objects on Screen (Crystalline Lens)
Muscles Which Regulate the Thickness of Lens
Pulley Muscle
Tough Outer Coat (Sclerotic)
Black Inner Coat (Choroid)
Object Screen (Retina)
Nerve Wires to Main Offices Optic Nerve
Other Muscles For Moving Eye

The eyes not only take pictures, but they take them very much as a camera does. If you were taking a snapshot of that bird at the top of the illustration, the picture thrown on the film would be inverted, just as it is when it strikes the retina of the eye, because the light rays are made to cross each other by the action of the lens. You will understand this better if you read the article on Lens. Again, the image has to be focused in the eye, just as in the camera. The article on Photography shows you how this is done in the camera by drawing the back farther away when the object is distant, but the length of the eyeball cannot be changed, and so the same result is obtained in a different way. The shape of the lens itself is changed by certain muscles, growing flatter for a distant object and more convex for a near object. Turn to page 1216 and you will see better how this is done. The iris of the eye corresponds to the diaphragm of the camera, regulating the amount of light which passes through. At the back of the eye you see the optic nerve—like a bundle of wires running to a telegraph office—passing back to the brain. It is from the brain that the eye gets orders to move. The moving is done by the working of the proper muscles. The little chap directing represents the working power of the brain.

take place throughout the system; the skin is also active in throwing off waste products So each of these organs deals with nutrition and the nourishment of our bodies.

In the second group we place those organs whose work deals with *relation*—that is, whose function is to bring us information of the outside world about us (the eye, ear, nose, organs of taste and touch) and tell us our relationship to it. In this group we may place the muscles, which control our movements and hence our relation to people and things; and also the bones, which support and protect our bodies and are used as tools and levers by the muscles. The business of each of these parts of our bodies concerns our relation to the world of things about us or the interrelation of the parts of the body.

The third group contains the organs of *intelligence*, which include the brain and nerves. These receive sensations, store up impressions as memories, make decisions and plans, and transmit suggestions and orders to other parts of the body. The quickness and clearness with which this group functions is considerably affected by the general health of the first and second groups. The old Roman adage, "a sound mind in a sound body," was founded on physiological fact.

The fourth and last group contains those organs whose work it is to reproduce their kind. These are known as the organs of *reproduction*.

Very closely related to the study of physiology is the study of *hygiene*. *Anatomy* tells us how the organ is made; *physiology* tells us how the organ works or functions; and *hygiene* tells us how to care for it and keep it well (*see* Hygiene).

So closely are these subjects related, and so important is a knowledge of them to our well-being and happiness, that we have made laws compelling them to be taught to the child in the schools. Knowing how our eyes are made and how they work, we also know how to protect and care for them so that they may serve us faithfully as long as we live. Knowing how our bodies are made, and how the various organs function, we will not take into them narcotics or stimulants or any other poisons which injure and break down the parts of these wonderful machines. For we learn that when any organ is not properly working, some other organ must work harder to counteract this defect. Only when every part is doing its work well, can we be happy. (*See* Blood; Brain; Digestion; Lungs; Nerves; etc.)

The physiology of plants is in principle the same as that of animals, but is much simpler as the activities of plants are simpler than those of animals and human beings. Nutrition and reproduction are the main branches of plant physiology. In the higher plants the root is an organ of nutrition for absorbing water, mineral salts, and organic matter which is soluble in water. The root, leaves, and stems are furnished with strands of tissues along which the water and food can travel readily. The leaves and at times the stem are organs for absorbing the carbon dioxide which the plant needs and for giving off oxygen, and they are also important in helping the plant to manufacture its food. And the flowers and seeds, which play so large a part in all the higher plants, are simply organs of reproduction to insure that the species does not die out. In addition all plants are more or less sensitive to sunlight, moisture, and other chemical influences, and even at times show movement in response to such stimuli; so we may say that there are some traces of organs of relation. (*See* Plant Life.)

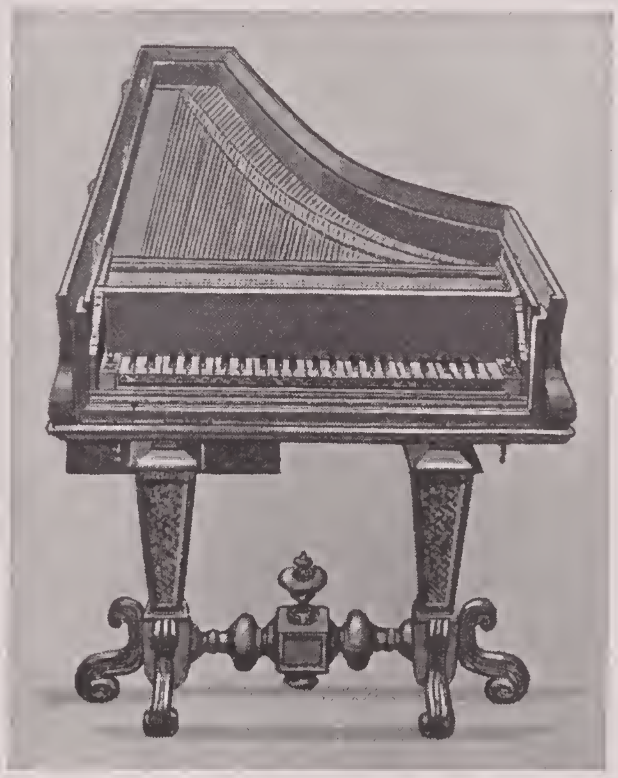
PIANO. The first of these popular musical instruments was built in 1709 by an Italian, named Bartolomineo Cristofori, in the city of Florence; and it was he who gave it its name, "pianoforte," because it could be played with either a soft (*piano*, in Italian) or a loud (*forte*) tone. But since the time of Cristofori every part of the mechanism has undergone great change, though the principle is still the same—an arrangement of keys which, when pressed, cause hammers to strike against tightly stretched strings and set them to vibrating.

There is a long history, however, back of Cristofori's pianoforte, for it in turn was a development from other keyboard instruments—the clavichord, harpsichord, and spinet. The "clavichord," the first of these to be invented, was a box-shaped instrument, with or without legs, in which wires stretched across a sounding board were struck by wedge-shaped blades of brass attached to levers and raised by keys. The strings vibrated so long as the brass blades remained in contact with them. The "spinet" differed from the clavichord in that the strings were plucked by quills, instead of being struck by blades of brass. The "harpsichord," the immediate forerunner of the piano, had quills to pluck the keys, like the spinet, but it was a much more elaborate affair. It was shaped like a grand piano, had two or more strings to a note instead of one as in the spinet, a number of stops to give various effects, and often it had two banks of keys.

Cristofori's pianoforte was so different from these that for a time it was not much used, because

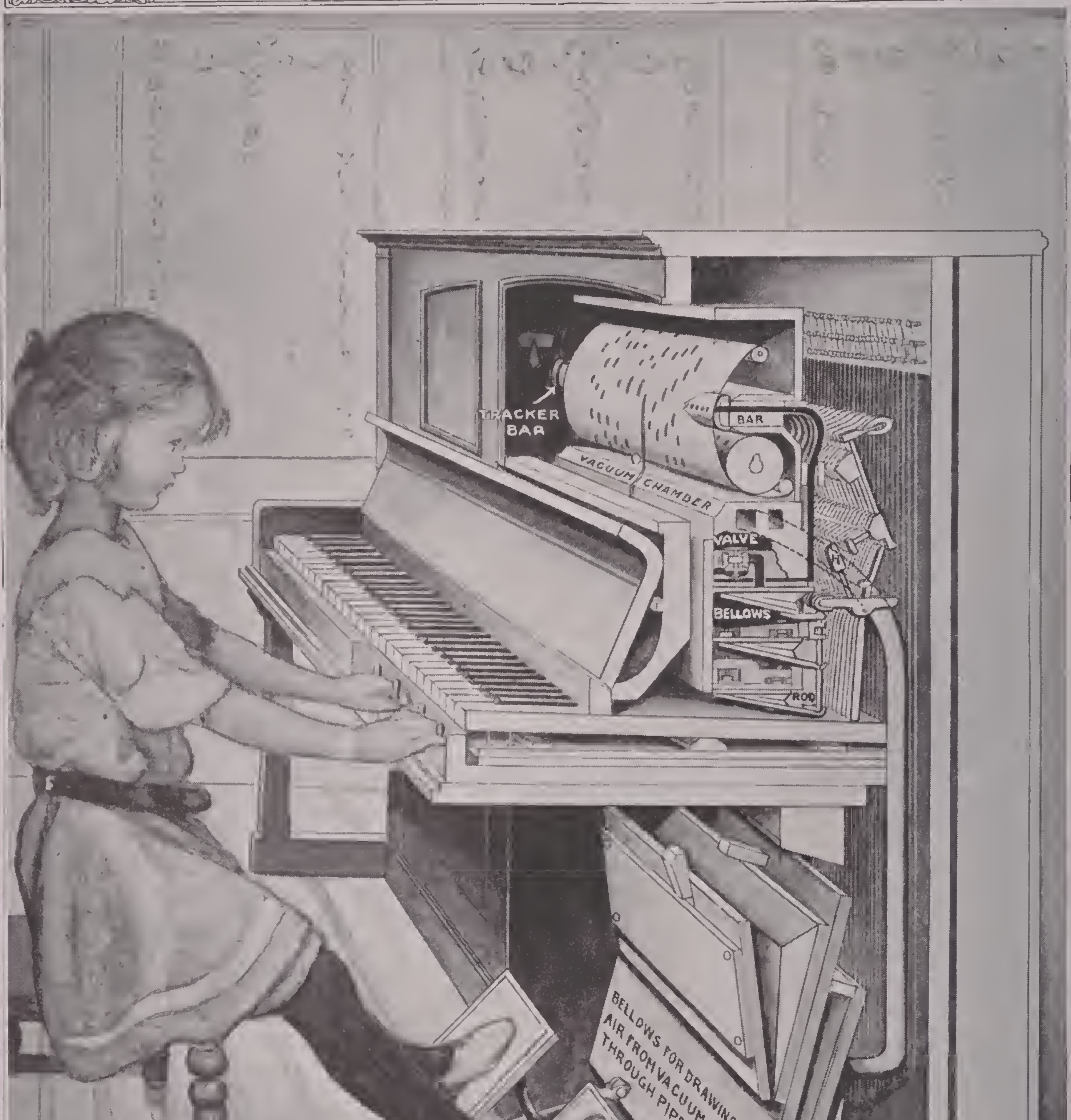
(*Continued on page 2801*)

OUR PIANO'S FOREFATHER



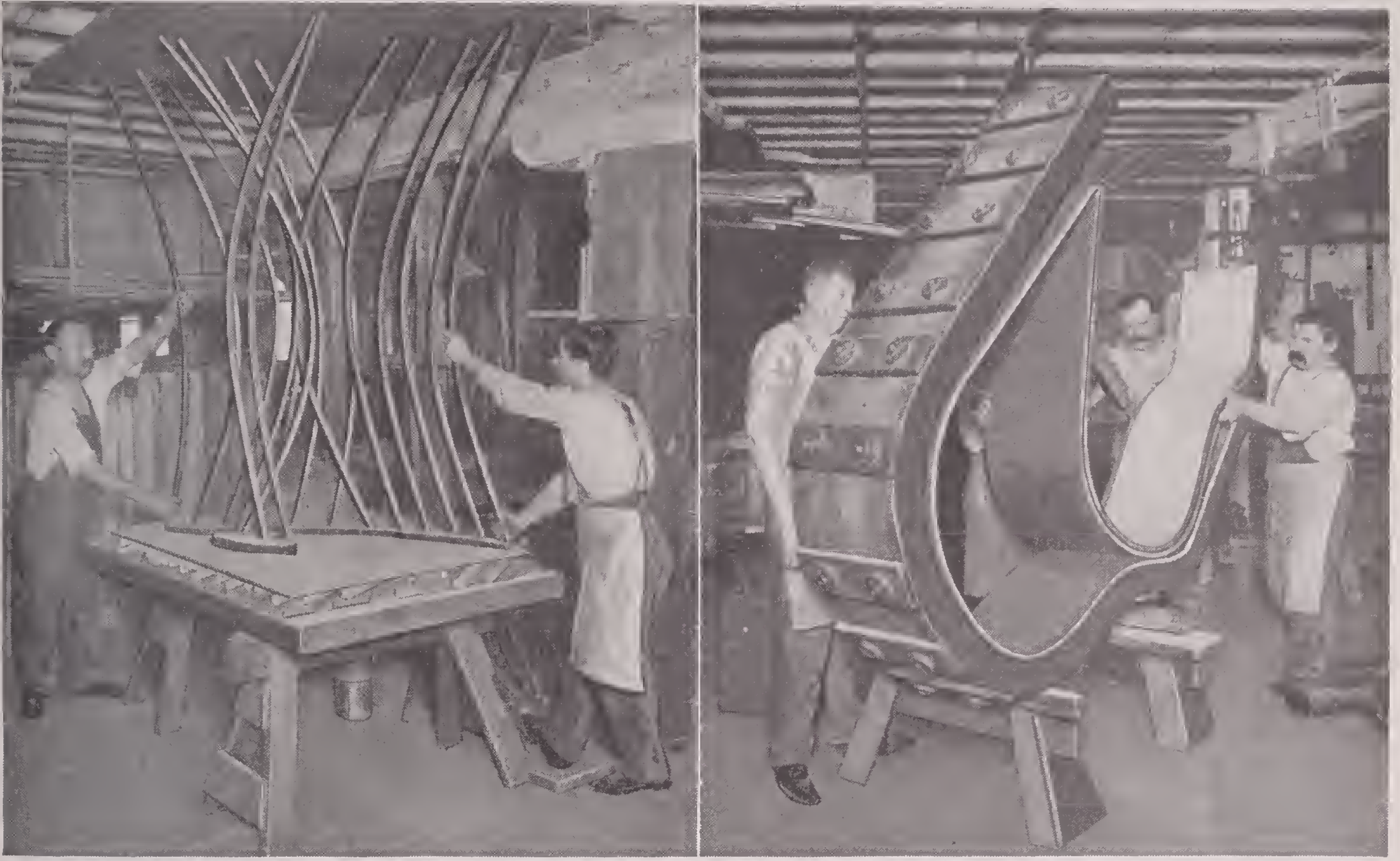
This instrument, built by Cristofori in 1726, is one of the two oldest pianofortes in existence. Its brother of 1720 may be seen at the Metropolitan Museum, New York City.

THE PIANO PLAYED BY FINGERS OF AIR

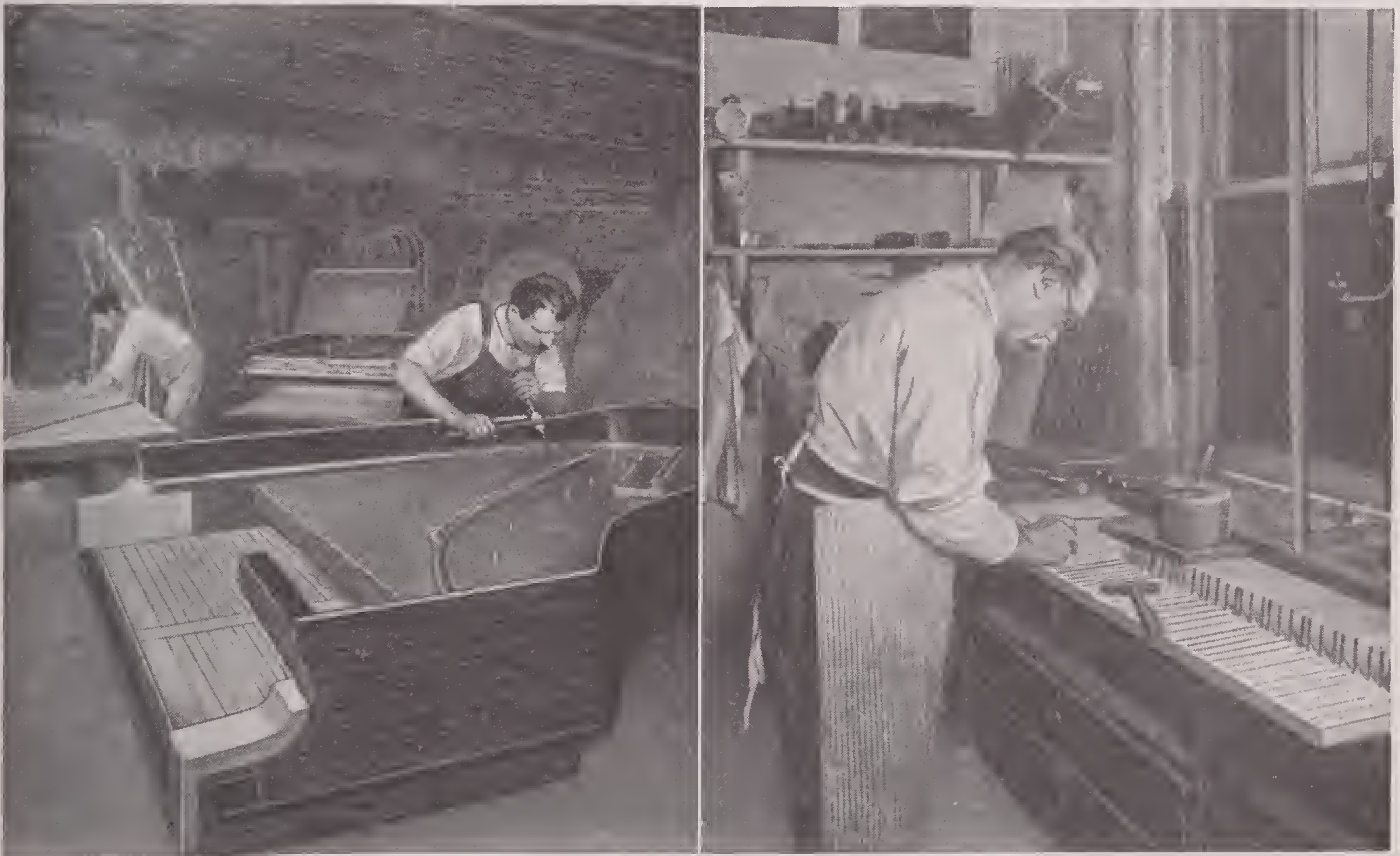

TRACKER BAR
BAR
VACUUM CHAMBER
VALVE
BELLOWS
ROD
BELLOWS FOR DRAWING OUT AIR FROM VACUUM CHAMBER THROUGH PIPE AT BACK

This ingenious application of air-power makes it possible for anyone to play the most difficult music without knowing a note. The tracker bar has a series of holes, one for each note on the piano, which lead into a corresponding series of long tubes. When the music roll passes across the bar, it admits air into the holes uncovered by its various perforations. The air, sucked down the tubes by the vacuum chamber, opens the delicate valves that control the action of the small bellows, and these in turn operate the levers that strike the hammers against the keys. The foot-pedals work a large continuous bellows which maintains the vacuum and furnishes the pneumatic power that turns the music-roll spools.

HOW THE PIANO GETS ITS VOICE

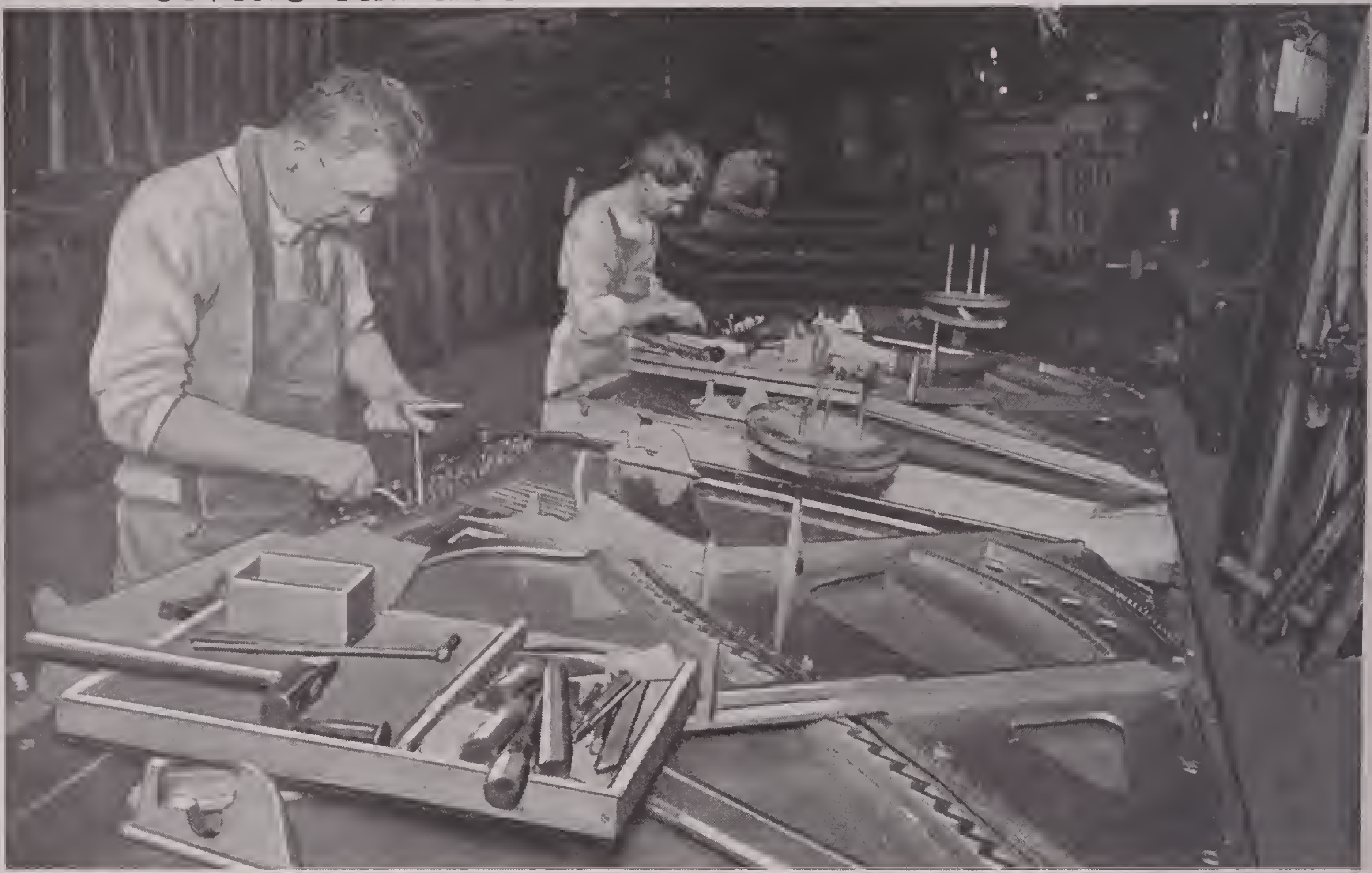


Those curved sticks at the left are pressing down on the sounding-board to hold the glued parts into place until they dry. Look at the sounding-board in your piano; it appears to be a solid sheet of wood; but it is made up of many slender strips of fine mountain spruce, skilfully glued together and arched slightly to resist the downward pressure of the strings as they cross the bridge. Its work is to receive and magnify the tones. The workmen at the right are taking a case rim from the shaping press. The rim is built up of long thin layers of selected wood to the desired thickness, bent, then seasoned for a long time.

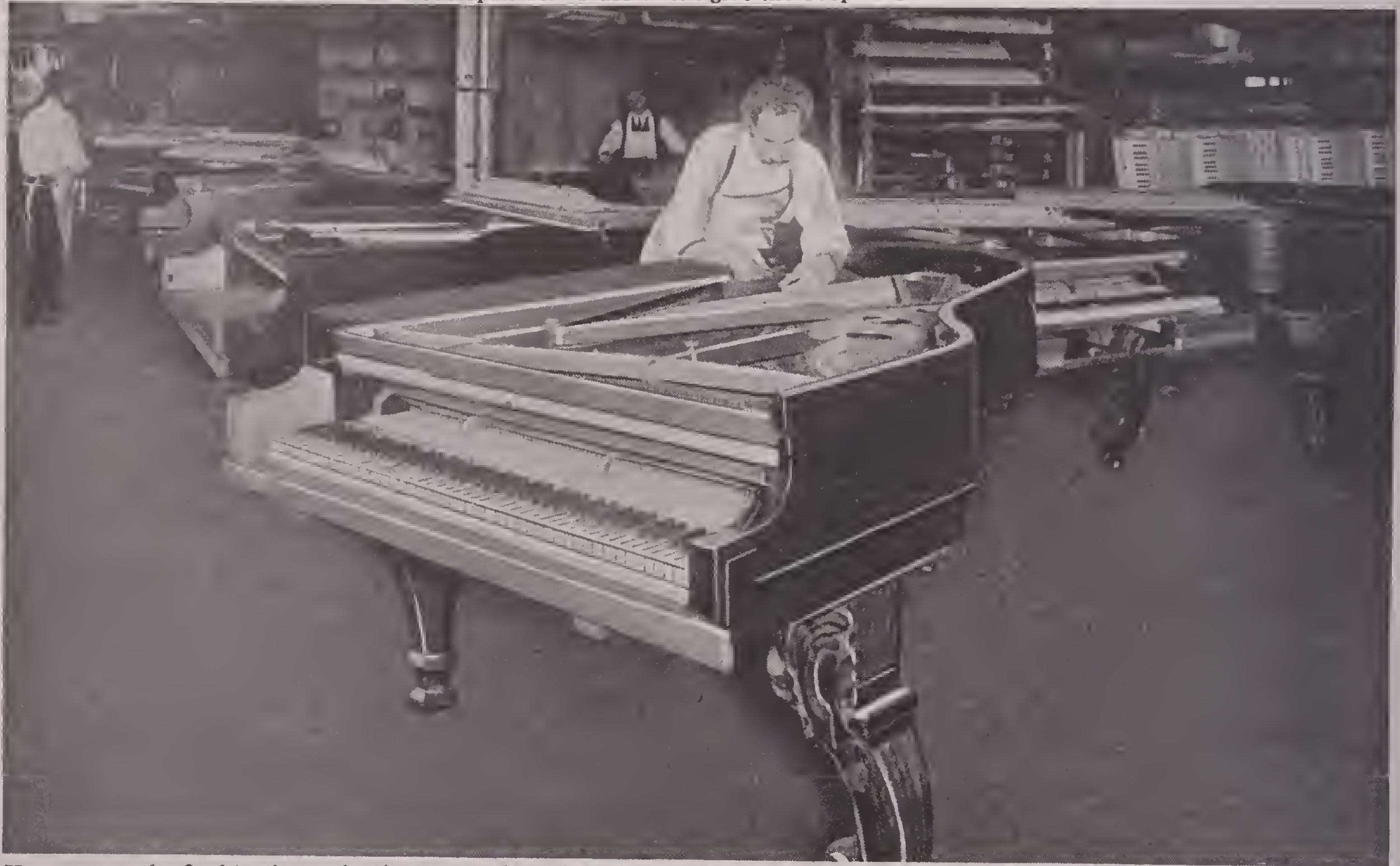


When the sounding-board, with the bridge fastened upon it, has been set into place, skilled workmen drill the holes for the series of pins across which the strings will pass. The bridge is constructed of alternating veneers of hard and soft wood, so that it can better transmit the tones to the sounding board. The man in the right-hand picture is making the piano's ivory keys.

GIVING THE HUGE THROAT ITS "VOCAL CORDS"



The metal plate must be able to withstand the 36,000- to 50,000-pound united "pull" of the strings secured to its pegs. Here the steel wire strings of the treble are being fastened on, and if we peep in later we shall see the man attaching the strings of steel wire overspun with brass which give the deep bass notes.



Here we see the final testing and adjustment. If we have been observant, our trip to the factory will have taught us that a piano is the product of highly skilled and patient workmanship. The metal plate must fit precisely so; the felt hammers must be pricked with different needles so they will pluck just such a tone from the strings; and oh, ever so many other things must be carefully done before it will sing as sweetly as it does.

musicians of that day found it hard to adapt themselves to the different touch required in playing it. Musicians found the tone of the new instrument weak, so makers set about giving it a stronger tone. This required stronger strings, more tightly stretched, which in turn required a stronger frame to endure the greater strain. It required also an improved sounding board and improved mechanism for the hammers that set the strings in vibration. These changes were followed by better ways of softening the tone, by easier action of the keys, and by many other improvements of great value in developing the instrument.

Do you realize how difficult a task it is to make a piano? The wood is chosen by a workman so expert that he can tell by its sound when it is struck whether it has the necessary qualities. Then it is weather-seasoned from three to ten years, and afterwards artificially dried for weeks. When it is at last ready for the workroom, it is cut into long thin strips. These are glued together to form a solid block of the proper shape and thickness for the case, and of great strength. Care is taken also to place the grain of the wood to the best advantage.

"Squares," "Grands," and "Uprights"

The form of the case determines the classification of the piano as "grand" or "upright"; the "square" form is no longer made. All the early pianos were "grands," though some were horizontal and some upright, and, because of its superior resonance, the grand is still the concert and artist's piano. The advantage of the square piano (invented about 1760), and its successor the upright (invented in 1800), is that they occupy less space; the upright especially can be used in homes where the concert grand, eight feet, six inches long, would be impracticable, and even the six-foot "baby grand" inconvenient.

Inside the case are the iron or steel frame; the "string-plate," attached to the rear end of the frame, to which the strings are fastened; the "wrest-plank," attached to the front end of the frame and holding the tuning pins, around which one end of the strings are fastened; the sounding-board, a thin piece of wood placed under the strings to intensify the sound produced by their vibrations; the steel strings running from the string-plate to the tuning pins; and the "actions," or mechanical device by which a touch on a key throws a hammer against the strings.

The sounding board, over which the strings are stretched, is made so that the grain runs from the lower bass corner to the upper treble corner, and the strips are placed so that those having a wide grain lie opposite the bass strings, leaving the finer grain for the higher-toned strings. The strings are tuned by turning the tuning pins. Their combined tension amounts to 10 or 20 tons, and the wrest-plank has to be made exceedingly solid to withstand this enormous strain. They have a tensile strength of 340,000 pounds to the square inch. They increase in length and thickness from the treble to the bass. The bass strings are overspun or wound with fine copper or mixed-metal wire in order to slow the rate of vibration. For the lowest tones only one string is used; for the middle tones, two strings; and for the upper tones, three strings. After it has been put into place, each string is given 16 tunings before it is finally drawn to the proper tension.

The "action" is a complicated piece of mechanism the principle of which is that when the outer end of the little ivory or ebony covered lever, the key, is pressed down, its rear end rises and lifts the "jack," which throws against the strings a wooden hammer while raising the damper from them. The head of the hammer is covered with compressed felt, increasing in thickness from treble to bass. The reason for the felt is that a hard-surfaced hammer leaves the string immediately after the stroke, and permits discordant partial vibrations to mar the tone, while the felt surface clings to the string long enough to damp the "partials." The ivory keys correspond to the natural tones and are called "naturals"; the short raised ebony keys correspond to the chromatically altered notes and are called "sharps." A modern piano has a compass of seven octaves, A to A, or seven octaves and a minor third, A to C.

The pedals are levers pressed by the feet to vary the tone. Usually there are two—the "piano," or soft, pressed by the left foot, which either throws the hammers nearer the strings, so as to lessen the striking distance, or changes the stroke so that one out of three strings is left unstruck but vibrating through sympathy; and the "forte," or loud, pressed by the right foot, which raises all the dampers so that the strings continue to vibrate after the release of the keys. Usually there is also a third or "tone-sustaining" pedal.

PIERCE *and His Troubled* ADMINISTRATION

The Story of the President Who had been a Brave Soldier and a Charming Gentleman, But Who Lacked the Strong Hand of Leadership—How His Change of Policy on the Slavery Question Brought Disaster

PIERCE, FRANKLIN (1804–1869). The 14th president of the United States was far from being a great man. From the biography written by his friend and college mate, Nathaniel Hawthorne, we see that he was a gentleman of truth and honor, with a fine physical appearance and charming manners. Most people were genuinely surprised when he was nominated as president by the Democrats in 1852. His nomination and election over Gen. Winfield Scott, the Whig candidate, can only be explained on the ground that, in a time rich in great leaders, it was felt safer to choose one who had played no conspicuous part and made no enemies.

Franklin Pierce was the son of a Revolutionary patriot of New Hampshire who had been twice governor of his state, and he had learned from his father a strong love of country. He was graduated from Bowdoin College in 1824, and after studying law for three years was admitted to the bar.

The prominent position which his father had occupied in the Democratic party in New Hampshire was a help to the son's political advancement. In 1829 he was elected to the state legislature and became speaker of that body. Four years later he was elected as a representative in Congress, supported Jackson's policies, and in 1837 was sent to the Senate. When he entered that body he was the youngest member in it, and as such great men as Webster, Clay, and Calhoun were numbered among its members, Pierce was completely overshadowed and his voice was never heard in debate.

Before his term in the Senate had expired he resigned—with the determination, as he said, never again to appear in public life. This resolution was faithfully adhered to for years, in spite of the fact that he was asked to become a candidate for governor of his state, and was offered the place of attorney-general of the United States in President Polk's cabinet.

When the Mexican War broke out, Pierce followed the patriotic example which his father had set and enlisted as a private. He was soon given a commission as brigadier-general, and served under General Scott with bravery and credit. On the restoration of peace he resigned his commission and returned home to the practice of law. In 1850 he was president of a convention to revise the constitution of his state. In due time his nomination as president followed, with William R. Ring of Alabama for vice-president; and Pierce and Ring were elected by 254 electoral votes against 42 cast for Scott and Graham, the Whig candidates, who carried only four states.

FRANKLIN PIERCE

PIERCE'S ADMINISTRATION
1853-1857
Gadsden Purchase from Mexico (1853).
Treaty with Japan negotiated by Perry (1854).
"Ostend Manifesto" issued (1854).
Know-Nothing Party at its height (1854–55).
Kansas-Nebraska Bill passed (1854).
Filibustering Expedition to Nicaragua (1855).
Border War in Kansas; John Brown and the Battle of Ossawatomie (1856).
Brooks' Assault on Sumner (1856).
Birth of Republican Party (1856).

When Pierce was inaugurated, on March 4, 1853, he was the youngest man who up to that time had taken the presidential oath. In his inaugural address he promised that he would uphold the Compromise of 1850, and that the repose which it had given the country should not be disturbed; but before his administration was over he had given his support to the Kansas-Nebraska Bill, which reopened the slavery question and led directly to the Civil War (*see* Kansas-Nebraska Act).

President Pierce's change of position on the slavery question was only one example of the indecision which was evident during his whole administration. He would make up his mind on a question in the morning, and change it in the afternoon. From being the most popular man in the country at the time of his inauguration, by December 1853 he had come to be regarded by many of his countrymen as one of the most incompetent men ever in the presidency. His cabinet, however, contained such men of ability as William L. Marcy, secretary of state; Jefferson Davis, secretary of war; and Caleb Cushing, attorney-general. It has the unique distinction of remaining unchanged throughout the administration.

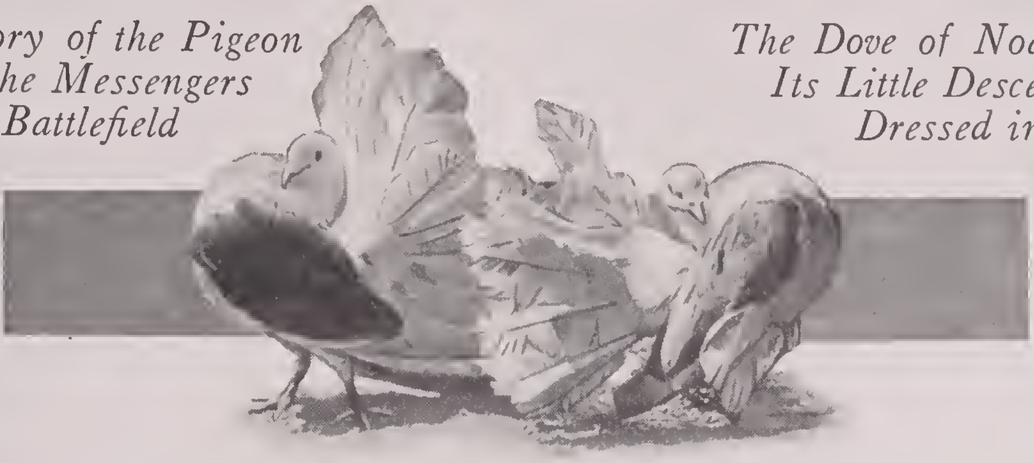
In foreign affairs President Pierce's administration is notable for a treaty concluded in 1854 by Commodore Perry with Japan, opening Japanese ports to American vessels (*see* Japan). By the purchase from Mexico, in 1853, of a strip of territory in southern Arizona (the Gadsden Purchase), the southern boundary of the country was rounded out.

The South was especially anxious to obtain more territory which could be made into slave states. This was the purpose of a notorious "filibustering" expedition against Nicaragua by William Morgan, which sought to set up a government there under American rule (1855), and with this movement President Pierce sympathized. It was also the motive of the Ostend Manifesto, signed by the United States ministers to France, Spain, and Great Britain, meeting at Ostend, Belgium, which declared that if Spain would not sell Cuba, the United States would take it by force. This declaration was condemned by most of the people of the United States. After completing his term, Pierce remained in retirement until his death in 1869.

The BIRD *of* PEACE *and Its* RELATIVES

Ancient History of the Pigeon Family—The Messengers of the Battlefield

The Dove of Noah's Ark and Its Little Descendants All Dressed in Gray



PIGEONS AND DOVES. Two billion pigeons in one flock is a big bird story but nevertheless a true one. Less than a century ago such a sight was common throughout North America; for the wild passenger pigeon (or wood pigeon) was often seen in flocks 200 miles long, and it was found nesting in such enormous numbers that, over a 150,000-acre tract of forest, 50 to 100 nests could be counted in a single tree. It is said that the noise of these flocks could be heard for a distance of three miles, and that thick branches often broke with the weight of the roosting birds.

Now, however, there is not a single living specimen of the passenger pigeon anywhere in the world. A prize of $1,000, offered for a pair of living birds of this species, has remained unclaimed for years. The last of the captive passenger pigeons died—an old, old bird—in the zoölogical garden of Cincinnati in 1914.

The passenger pigeon was about 17 inches long from tip to tail, and of a bluish gray color above and reddish faun below. From this under-color it was frequently called the red-breasted pigeon. Its wings and tail were long and pointed, giving it a neat tailored appearance. It fed upon fruits, seeds and grain, and nuts.

The sudden disappearance of the passenger pigeon is regarded by many as a mystery. It is easily understood when the reckless slaughter is considered, to which it was exposed as the country became more thickly settled in the middle of the 19th century. Firearms could do in one generation what the bow and arrow had left undone for centuries. One shot from a modern shotgun, fired into a pigeon tree, would bring down enough pigeons to fill a game bag. Yet, not satisfied even with this wholesale killing, fowlers set large nets which sometimes took from 200 to 250 birds at one haul. The young just out of the nest, called "squabs," were especially marketable, for they were tender and toothsome.

Expert pigeoners followed the flocks from roosting place to roosting place, tracing their whereabouts by telegraph, and overtaking them by railroad.

The last recorded great nesting and slaughter in the United States occurred in Petoskey, Mich., in the year 1878. It is said that from this nesting-place tons of birds were sent to the New York market, and that it took 15 tons of ice to pack the squabs alone.

For 25 years following this raid, flocks were occasionally seen in various parts of the United States. But they were in ever diminishing numbers, and they were ever relentlessly pursued until their extermination became complete.

The pigeon family has an ancient history. The names "pigeon" and "dove" are used almost interchangeably; the former comes from the French and Italian (from the Latin *pipio*), while the name "dove" is akin to the Dutch *duif*. Commonly—but not always—the smaller members of the group are called "doves" and the larger ones "pigeons."

To this family belongs the famous dove of Noah's Ark. This bird must have been held in high regard by the early Hebrews, for it is recorded that the poor were permitted to substitute turtle doves for sacrifice, in place of lambs.

The American turtle dove, which is akin to the European species and is also known as the mourning dove, is well known in most parts of the United States. Its soft gray plumage with a collar of changing amber lights, its sad little cooing call, and its quiet friendly habits endear it to all. (For illustration in colors, *see* Birds.)

The Many Species of Pigeons and Doves

More than 500 wild species of pigeons and doves are known throughout the world. They are most numerous in the Eastern Hemisphere. The birds vary greatly in their habits. Some build in trees, others on the ground; some nest in isolated pairs, others in colonies. However, they all have one mannerism that is theirs alone—in drinking they do not lift the head as other birds do, but take the water in long draughts. The pairs mate for life. During the hatching season the father and mother take turns in keeping the eggs warm, and both care for the babies. There are about 17 species in the United States.

Pigeons were early tamed, and domestic pigeons are now common throughout the world. Three thousand years before the birth of Christ, the Egyptians raised pigeons for food, and the carrier or homing pigeons also have an ancient record.

The 150 named varieties of domestic pigeons, in spite of their great differences, have all been traced to the common ancestry of the wild rock-dove of Europe and North America. This fact was made known by the great scientist, Darwin, who, in establishing his theory of "natural selection," found the pigeon one of his most plastic subjects for experimentation. He discovered that triple crosses between distinct varieties, of no matter what color, were very likely to produce, in the third generation, a color pattern precisely like that of the wild rock-dove, which wears a plumage of grayish blue color with white on the lower back and two black bars on the wings.

Domestic pigeons are divided into four principal groups. The pouters are a very distinct race, having an oesophagus and crop that can be enormously inflated. A second group—having large feet, a long beak, and a rough wattled skin about the eyes—includes the carriers, dragons, runts, and barbs. Another group, with short beaks and naked skin about the eyes, includes the fantails, turbits, tumblers, and frill-backs. Finally there are those that more nearly resemble the rock-dove—trumpeters, laughers, nuns, spots, and swallows. Next to the pouter, the fantail differs most from its original family, for it has from 36 to 46 quills in the tail, whereas the common rock-dove has but 12.

WHY THIS PIGEON LOOKS SO PROUD

The Maltese or " Hen Pigeon " is a very proud and showy bird. These birds always attract much attention at pigeon shows because of their peculiar carriage.

The carrier or homing pigeons are the most remarkable of the domestic species. These birds possess a sense of direction which is more than human, and they are easily trained to carry messages several hundred miles to their distant homes. This use is of long standing, for pigeon-posts were established at the time of the First Crusade. Numbers of these birds are kept by pigeon clubs, which hold races to test their speed, the pigeon clubs of Belgium being among the most celebrated. The highest speeds recorded for a carrier pigeon are 72 miles in two and one-half hours, and 180 miles in four and one-half hours, or 40 miles an hour.

During the World War, where telephone and wireless communication was not possible, the services of these feathered messengers won for them the praise and admiration of the world. All the armies made use of them. At one point 12 miles behind the French lines, the British kept 60 pigeons housed in a London motor-bus. The outside had been roofed to form their cage, while the attendants, consisting of a chauffeur, trainer, and orderly, slept inside. A perch was cleverly arranged before the opening in the front, so that when the birds alighted on returning from their flight, an electric bell aroused the men inside, day or night.

The pigeons were taken out to the trenches in baskets to serve as needed. If not used in 24 hours, they were released anyway with some message, to keep them in practice. Birds were always sent in couples with the same message, so that if one happened to be killed, there would still be a chance of the message arriving safely. One of the numerous French pigeons which won a "ring of honor" for its leg was thus cited in the official dispatches: "Despite immense difficulties from smoke and gas it accomplished the mission with which it was entrusted. It reached the pigeon house badly gassed and utterly exhausted."

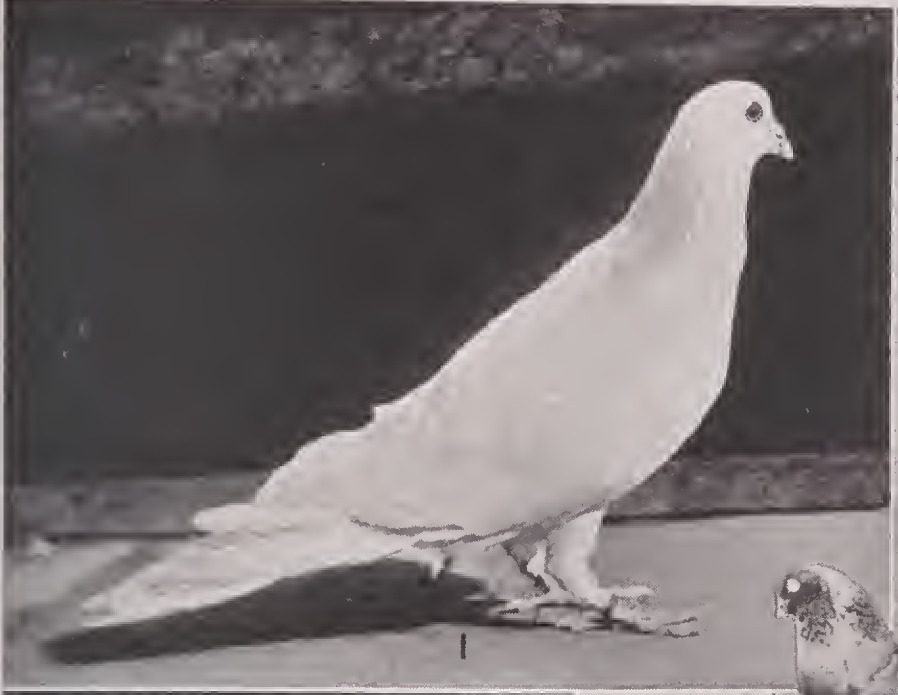
The growing of pigeons as a commercial industry is common in America and Europe. The squabs, or young birds, when four weeks old, bring high prices in all markets.

Boys and girls who own a pair of pet pigeons often find that the birds will desert their private apartment for the crowded loft of a neighbor. This is because pigeon nature demands sociability. Domestic pigeons, as well as most of the wild species, prefer to live in large flocks. Two points to remember in caring for these pets are—first, that they require salt; and second, that they do not dust their bodies, and therefore are fond of bathing. Aside from these points the care of pigeons is similar to that of other feathered pets (*see* Pets and Their Care).

In all, more than 650 forms of pigeons are known. Approximately half of this large number is made up of the "fruit pigeons" of the Orient. These birds possess much more richly colored plumage than their European and American relatives. Curiously enough, wild pigeons are never found in regions where monkeys exist, because these mischievous creatures are so successful in stealing eggs that the birds cannot hatch and bring up their young.

Pigeons and doves constitute the order *Columbae.* Scientific name of wild passenger pigeon, *Ectopistes migratorius;* of mourning dove, *Zenaidura macroura;* of wild rock-pigeon, *Columba livia.*

DISTINGUISHED MEMBERS OF THE PIGEON FAMILY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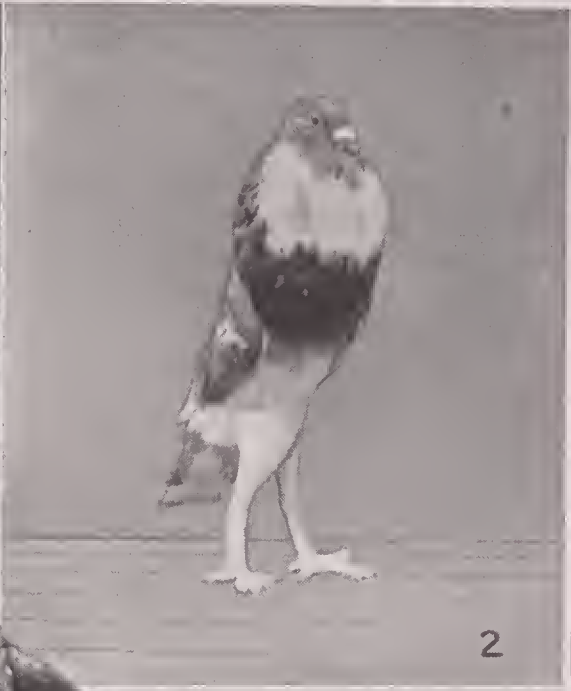
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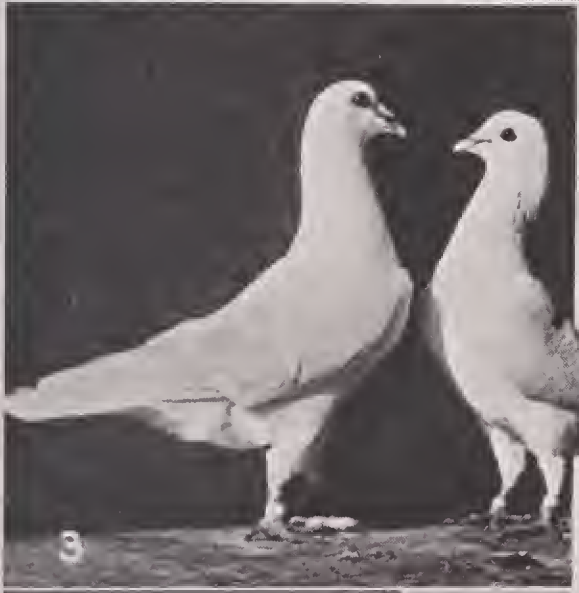
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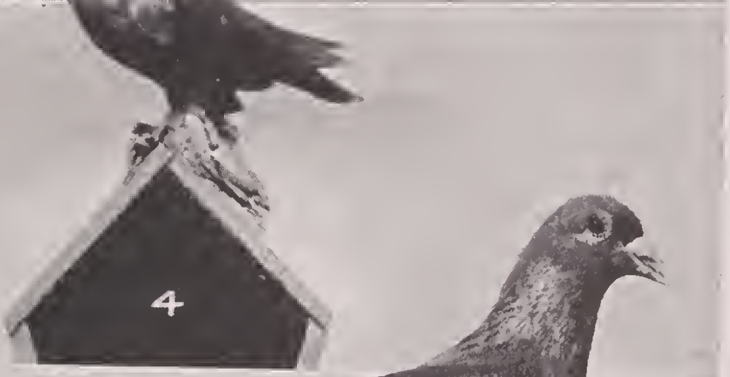
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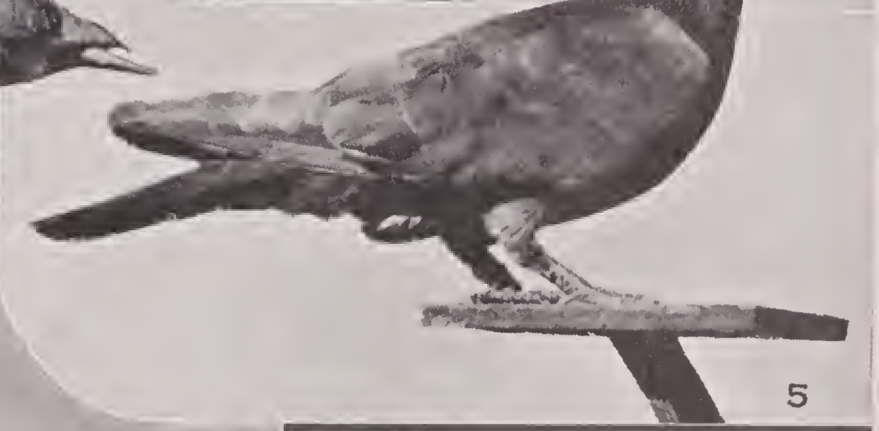
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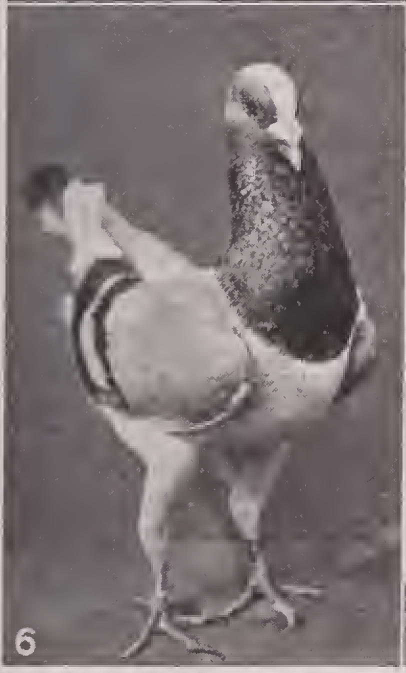
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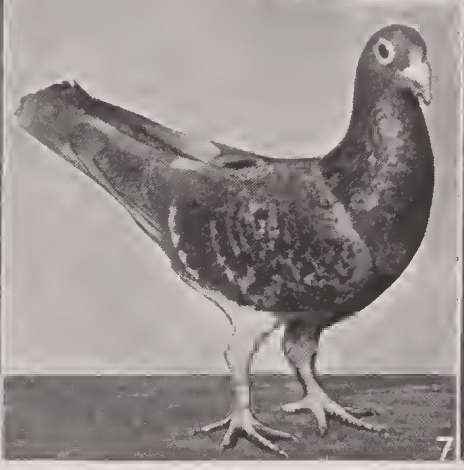
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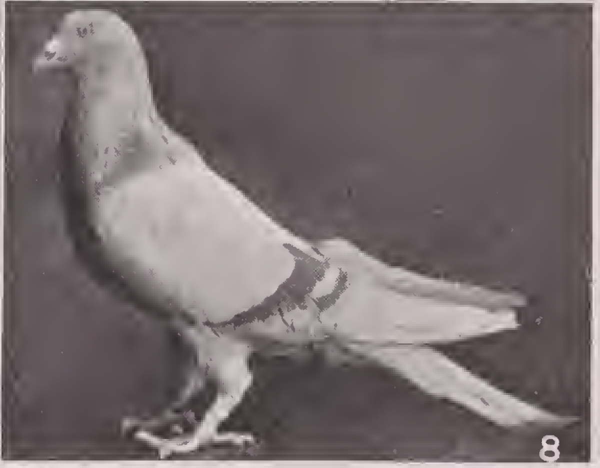
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The White Swiss Mondaine (1) is used principally for squab breeding. The Red English Pouter (2) often "pouts," or inflates his crop with air, so vigorously that he falls over backward. The White King (3) is an excellent squab producer. The Black Muffed Tumbler (4) doesn't "tumble." He merely belongs to the Tumbler family. The Red Carneau (5) is favored as a squab breeder. The Hungarian Pigeon (6) is noted for his beautiful markings. The Racing Homer (7) is famous for flying exploits, both in peace and war. Such a thing as a "Giant Runt" seems impossible, but there he is (8). The "Runt" is a corruption of his old Roman name, and the "Giant" was prefixed to show that he is really quite large.

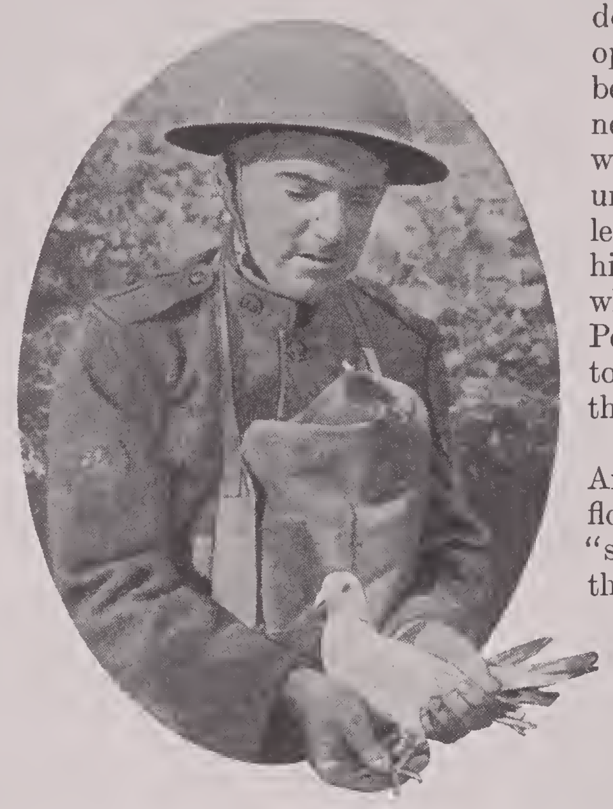
The Pigeon That Won A War Medal

"CHER AMI" as he is called—which is French for "dear friend"—wears the feathered uniform of Pigeon Company No. 1 which is part of the great American Expeditionary Force.

When with his 20 khaki uniformed men, he was sent "Over There" in the service of his country, his little pigeon heart was full of Yankee pride, and in his own bird way he vowed that he too would "do his bit!"

Cher Ami's first duty was to remember every thing about his new coop at Rembrandt, back of the fighting line in France. This he did so quickly that his captain very soon remarked, "Cher Ami is a real soldier"; which meant that he could be trusted.

That was why he was sent with the Seventy-seventh Division right into the thick of the fighting in those thrilling days of the Argonne struggle. And, when his own battalion was beset and left unsupported in that strange desperate enemy country, how Cher Ami did want to fly with the message for help! And sure enough, the cage door was opened, and with the words, "Do your best, Cher Ami!" his captain fastened to Cher Ami's leg the precious little message tube telling of the "Lost Battalion's" plight.



"The hand of the sergeant who fastened the message tube under the feathers of Cher Ami's left leg also trembled for joy, and his voice shook a little as he whispered, 'Straight to General Pershing, Cher Ami!'"

Up into the air he circled. An instant only did he hesitate, and then off like a shot he darted, straight for the Rembrandt coop.

How he did fly! Perhaps he knew that he had been sent because there was no telephone connection, and no way of sending a wireless. Perhaps he told himself that he must act in their stead.

So swift and sure was Cher Ami's flight that the "Lost Battalion" gives him credit for the help that came "just in time." For the captain told Cher Ami so, as he stroked the feathers of the faithful little messenger, the next time he saw him.

But Cher Ami wanted to do more. One great deed was not enough when his country was battling to "make the world safe for democracy."

He heard the soldiers about him talk of General Pershing, the commander of the whole Expeditionary Force, and of how a word of praise from him meant more, so they said, than even a "D.S.C."—referring to the distinguished service cross. "I'd like to fly for General Pershing," thought Cher Ami, not dreaming that he was soon to have his wish.

Soon there came the great day when the "Yanks"—with the Seventy-seventh included—crossed the Meuse River opposite Sedan. They had reached the goal set for them, having defeated the enemy and cut his line of communications. Nothing but surrender or an armistice could now save the German armies!

How Cher Ami trembled with joy when the cage door of his field basket was opened and he knew that he had been chosen to carry the glad news! The hand of the sergeant who fastened the message tube under the feathers of Cher Ami's left leg also trembled for joy, and his voice shook a little, as he whispered, "Straight to General Pershing, Cher Ami!" And then tossed the trusty bird high into the air.

Like a flash of lightning Cher Ami was off. Never had he flown so swiftly. But German "snipers" were still about, on the lookout for just such messengers. Amid the flash of shots there came a sharp sudden pain. A German bullet had grazed Cher Ami's breast, and, his left leg, with its precious tube, was broken and dangled by a mere shred of bleeding skin. With all his strength Cher Ami drew the stub of his leg and its precious message close up to his breast. He felt the blood drop, drop, dropping away, but he never wavered in his flight.

On he flew, 37 long miles. Would he ever reach that coop—and General Pershing? Cher Ami did his best, and at last alighted on the welcome perch. Just as the coop door opened, he fainted.

It was a strange hand, gently stroking his feathers, that finally awakened Cher Ami. He felt very queer and weak and lay quite still, not even caring to open his eyes. Then he heard a strange voice saying:

"Cher Ami shall be recommended for the D.S.C. There isn't anything the United States can do too much for this bird. I want him back in Washington, the best-cared-for bird that ever was."

The strange voice paused and the familiar voice of Cher Ami's captain answered:

"Yes sir, General Pershing. You trust us to take care of him."

Cher Ami opened both eyes with a stare. General Pershing! The D.S.C. *and* words of praise!

You may be sure that Cher Ami is a proud and happy bird today as he recalls in the comforts of peace the hardships and glory of the World War.

PILGRIMS. In the Middle Ages men and sometimes women often traveled long distances as pilgrims in order to visit spots made holy by their connection with the Christian religion. The tomb of Saint Thomas Becket at Canterbury, in England, and that of Saint James of Compostella, in Spain, were important places of pilgrimage; but the most renowned were the shrines of the apostles Peter and Paul in Rome, and the holy places of Palestine, connected with Christ's life on earth. Hope of healing for diseased bodies or souls, a love of adventure, and the desire to see new lands all sped the pilgrims on their way to the sacred places.

Pilgrims were under the special protection of the church. The marks of a pilgrim consisted of the broad-brimmed pilgrim's hat—usually adorned on the return with sea-shells and leaden medals of the saint—together with a staff, sack, and cup for drinking. Wealthier pilgrims rode horseback, and often traveled in considerable companies, as described in Chaucer's 'Canterbury Tales' (*see* Chaucer). The humbler sort traveled on foot. They lodged in monasteries or in separate "hostels" established for their aid, especially on the great Alpine passes, in the chief cities of Italy, and in Jerusalem. Pilgrims returning from Palestine usually carried palm leaves and hence were called "palmers."

Books were written as guides for the pilgrims, directing them as to their routes, and telling for example how much they should pay for their sea-passage from Venice to the Holy Land, and of the preparations for the voyage. They must take with them a feather-bed, with pillows, sheets, and blankets; and they must take provisions for their private use, as well as necessary medicines. When they landed they must beware alike of foreign fruits and robbers. A list of phrases in foreign tongues was usually given, so that the pilgrim might ask his way and purchase necessary things. The stopping by the Seljuk Turks of pilgrimages to the Holy Land was one cause of the Crusades (*see* Crusades).

(For an account of the Pilgrim Fathers, who first settled Massachusetts, *see* the articles 'Mayflower' and Plymouth, Mass.)

PIN. A pin costs so little that we scarcely think it worth while to waste time picking one up, yet they were once so expensive that only the rich could afford them. The change has come about through the invention of machinery which can turn out pins in such enormous quantities that the cost of manufacture is only slightly greater than that of the brass wire from which they are made.

The world is practically supplied with pins made in the factories of the United States. It has been estimated that every man, woman, and child in the United States uses 125 pins every year. It is also estimated that only one pin out of every hundred is worn out or broken in use, the other 99 being lost and oxidized (rusted), and so returned to the soil from which the ore came.

The common pin is made of brass wire, coated with tin. From the time the wire is fed into the machine until the pins are stuck into the paper strips, ready for packing, the action is automatic. The wire is cut into proper lengths, the heads formed by a die, and the points ground—all without the touch of human hands. Then the pins are dipped in acid to clean them and receive a bright coat of metal by immersion in a solution of tin. Pushed along slowly until they have hardened, they drop into a revolving barrel of bran which cools and polishes them. They are then fed into a hopper with a steel plate at the bottom cut into slits just big enough to allow the body of the pins to fall down in them, but not the heads. Thus straightened out in rows, they move toward the edge and slide down an inclined plane. At the bottom of the inclined plane are the strips of paper, in which the pins are caught and inserted. The mechanism is so delicate that the least imperfection in one of the pins will stop the feeding until the obstruction is removed. One of these machines will stick 100,000 pins an hour. Hairpins, safety pins, and other kinds of pins are manufactured with similar machinery.

In the Egyptian tombs ornamented pins of brass, gold, and silver have been found, sometimes seven or eight inches long. Various species of thorn were often used as pins by early peoples. In Revolutionary times in the United States the heads of pins were made by twisting fine wire into a knob and soldering it firmly to one end. The first machine for making solid-headed pins out of a single piece of wire was invented by Lemuel W. Wright of New Hampshire in 1824.

PINE. Of all our forest trees the pines are among the most beautiful, the most numerous as to species, the most widely distributed, and the most useful to mankind. They are practically confined to the Northern Hemisphere, and are common alike in Asia, Europe, and America. In size they range from a few feet in height to majestic species towering to 200 feet or more. They frequently form extensive forests scarcely mixed with other trees. A few species extend even into the tropics, these being found on the mountains of Central America. There are about 37 species in the United States alone, of which 25 occur in great forests of the western states.

The magnificent White Pine is one of the finest of forest trees, reaching a height of 80 to 175 feet.

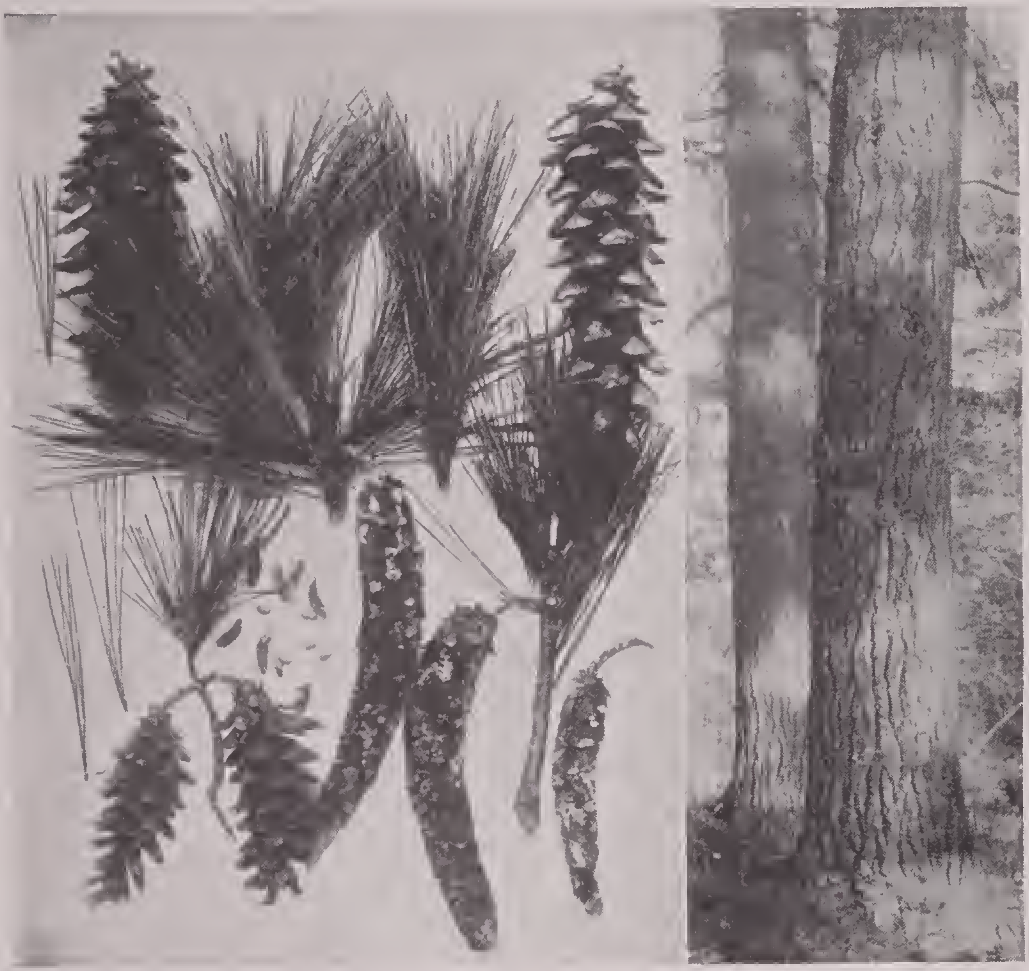
The most common species in the United States is the white pine, a magnificent tree attaining a height of 80 to 175 feet. The branches, whorled horizontally about the splendid erect columns, are densely clothed in bluish green and gray needles, growing in small clusters of five needles each. The tree tapers gracefully and is very picturesque. It bears long slender solitary cones which are slightly curved. The bark is greenish-gray and rather smooth on the younger trees, becoming rough and brown with age. The tree is a favorite with lumbermen because of its strong, clear-grained, easily worked wood, and consequently is much rarer than formerly.

The red or Norway pine is also a beautiful tree, having reddish brown bark from which it gains its common name. Though often attaining the height of the white pine, it is sometimes rather dwarfish. The branches are few and the needles, which grow in clusters of two, form sparse clumps at the ends of the short twigs. The appearance of the tree is rather light and airy. It bears small oval-conical cones.

The yellow pine or long-leafed Georgia pine is conspicuous for its needles, which are often a foot in length, growing in clusters of three. It is a very slender stately tree, rising to a height of 50 to 120 feet. The trunk is bare of limbs to a great height, and is covered with orange-brown bark which separates into scaly plates. The cones are large and coarse.

A veritable giant is the western yellow pine, often called the great yellow pine, which occasionally rises to a height of 230 feet and which frequently is 150 feet in height. The needles, which grow in clusters of three, are long and twisted; the small oval cones have recurved prickles.

WHY PINES ARE SUCH MOUNTAIN CLIMBERS



"The pine trees," said John Muir, the famous naturalist, "march up in long, hopeful files, taking the ground and establishing themselves as soon as it is ready for them." Haven't you often wondered why pine trees are such mountain climbers? The picture tells you this, among other things. The two great trunks are those of the white pine, while in the group to the left are mature cones, clusters of needles, young cones, and the winged seeds, some with the wings detached. By their wings the seeds are carried with the wind up the mountain sides. It is really wonderful how little soil a pine tree can get along with, if its fortune is cast on some mass of mountain rock.

The loblolly pine covers great areas in the Southern states. It is very hardy and frequently springs up in devastated and impoverished land. It grows to a height of 80 to 90 feet and sometimes has a girth of six to eight feet. The needles are rather long, growing in groups of three, and are light green in color. The cones grow in pairs and are quite large.

The pine most common in northern Europe is the Scotch pine. In perfection it is one of the finest trees of the group. When young it is conical in shape, but when older the branches become spreading and twisted, giving the tree a mushroom-like appearance. It grows to a height of 70 to 120 feet. Its dark green needles grow in clusters of two, and the cones are rather small and compact. This species is not native to America, but is among the most important of our cultivated trees.

The soft, straight-grained, resinous, and durable wood of the pines has placed them among the most valuable of timber trees. They not only furnish a superior quality of lumber but are rich in turpentine, resin, and tar, materials essential to many industries. For all indoor and outdoor purposes the wood of the Scotch pine is practically as durable as the oak, and its value as ship timber is but slightly less. It is said to be the best of all woods for ship masts and large spars. The white pine, which is perhaps more important commercially than any other North American tree, is adapted to the same purposes as the Scotch pine, though it is slightly less durable, decaying rapidly when exposed to the moist air. The red pine is also valued for its lumber, though it cannot compete with that of the white pine. The lumber of the western yellow pine is extremely dense and heavy, barely floating in water. The southern yellow pine not only furnishes lumber with a beautiful grain, but produces vast quantities of turpentine and tar. The loblolly pine yields timber and great quantities of turpentine.

The true pines are readily distinguished from the spruces, firs, larches, and cedars by their foliage and cones. The leaves, which are evergreen, needle-shaped, and from a little more than an inch to more than a foot in length, usually grow in clusters of two to five, according to species, sheathed at the base by thin chafflike scales. Their pendulous cones are peculiar in the thickening of their persistent woody scales into a more or less pyramidal elevation at the top, with a boss in the center which is often prominent or hooked.

Scientific name of the white pine, *Pinus strobus;* range, Newfoundland to Manitoba, along the Alleghenies south to Georgia. Red or Norway pine, *Pinus resinosa;* same range as white pine. Southern yellow pine, *Pinus palustris;* North Carolina southward to Texas. Western yellow pine, *Pinus ponderosa;* British Columbia to Mexico and east to Nebraska and Texas. Loblolly pine, *Pinus taeda*. Scotch pine, *Pinus sylvestris.*

PACKED WITH SWEETNESS

The Pineapple plant produces but a single fruit, but into that fruit it packs an enormous supply of sweet pulp and juices. The Pineapple gets its name from its resemblance to certain kinds of pine cones.

PINEAPPLE. A formidable array of stiff, prickle-edged, sword-pointed leaves stand out in all directions on the rosette-shaped pineapple plant and form the natural protection for the single, fragrant, delicious fruit borne at the top of the main stalk. Before going into the pineapple plantation to gather the ripened fruit the harvesters carefully protect themselves from the plant's defense weapons by covering their hands with thick gloves or mittens and by wearing leather trousers or wrapping their legs with thick cloth and strips of matting. Each stalk produces only a single fruit. With short hooked knives the fruit is cut from the stalk and either tossed to a helper or placed in a gunnysack slung across the shoulders of the picker. Each "pine" is slipped into a paper bag or wrapped separately and closely packed for shipment to prevent bruising in the cars and vessels.

The pineapple (*Ananas sativus*) is a native of tropical America, but is now grown in most tropical and semi-tropical countries. The large fully ripe pineapple cannot be enjoyed in the distant market, however, for the fruit is picked before it is ripe and grows mellow during transportation. Besides the common market variety there are several varieties which do not keep well for shipment, particularly the yellow-fleshed "Egyptian" and the luscious giant "sugarloaf." Our supply of the fruit comes chiefly from central and southern Florida, West Indies, Bahama Islands, and from Hawaii, where a rapidly growing industry supplies quantities of the canned fruit. Pineapples are also grown in the Azores, North Africa, and Queensland. They need little cultivation and do not require a rich soil, producing well even on the Florida Keys where only one or two inches of soil covers the coral rock. Superior fruit is grown under cover of slat sheds which protect them from excessive heat and also prevent injury from frosts, whose visits are rare but very destructive to the pineapple plantation.

What we call the fruit is really the fleshy flower stalk. Parts of the individual flowers can be distinguished by careful examination of the scales on the hard brown rind. The fruit of the wild plant frequently contains seeds, but cultivation has discouraged seed production in the interest of thicker fruit pulp. Plants are propagated by setting out the green crown of the fruit and more commonly from the suckers at the base of the old plants and from rattoons or root buds. The plants bear from eight to ten years without resetting. The large leaves of the pineapple contain valuable fiber used in the piña-cloth imported from the Philippines.

PINK. Much of the spicy fragrance that hovers around old-fashioned gardens comes from the pretty fringed-petaled flowers called the pinks. Among these is the clove pink, once called "Jove's flower," which is more familiar to us in its cultivated double-flowered form, the carnation. Another favorite is the sweet-William, whose gorgeous bunches of velvety blossoms with quaint markings of white and various tints of red are, as an old English flower book puts it, "worthy the respect of the Greatest Ladies who are Lovers of Flowers." Other familiar garden sights are the sweet smelling common pink with its grasslike leaves of gray-green and its pale pink and white petals that are always "spilling over," and the China pink, whose red blossoms with their strange markings keep blooming all summer long. (*See also* Carnation.)

The pink is a genus (*Dianthus*) of the family *Caryophyllaceae* and has about 70 annual and perennial plants which are natives chiefly of Europe and the temperate parts of Asia. Its showy flowers, solitary or clustered, have jagged-edged petals, and narrow grasslike leaves. Some wild flowers of this family but not of this genus are also called pinks, among which is the fire-pink (*Silene virginica*), whose showy flowers of bright crimson bloom in early spring.

PIRATES AND PIRACY. Stories of pirates and buried treasure, of the "Jolly Roger,' the black flag with the skull and cross-bones, of captains and crews "walking the plank," while the cut-throats of the Spanish Main sang terrible deep-sea songs to the time of waving cutlasses—such tales have been read and re-read by English and American children for generations. They usually end with the pirate chief hanging at the end of a ship's yard-arm, after his black band has been sent to "Davy Jones's locker" in a hot fight with a man-o'-war.

In these tales there is at once more and less than the truth. When history's microscope is turned on the pirate, he usually turns out to be a dismal villain without a trace of romance. He played on the high seas the same part that the bully leader of a sneaking band of thieves and murderers plays on land. On the other hand, pirates were by no means always punished or even discouraged in their lawless employment. Men of position and wealth at times provided them with ships and equipment in return for a share of the booty. Even governments sometimes gave secret support to adventurers whom we should regard as pirates, provided they attacked only enemy or neutral vessels.

The Rivalry of the Seas

To understand this attitude, one must realize the intense rivalry that existed on the seas during the 16th, 17th, and 18th centuries. Even when peace reigned on land, the ships of England, Spain, Holland, France, and Portugal continually struggled and fought to get the upper hand in the commerce with the West and East Indies and America. The assistance of rogue sea captains was not scorned in the contest, and it was an easy step for these shipmasters to turn from patriotic fighting to private buccaneering.

Piracy has existed since the earliest days of seafaring. From the times described in Homer's 'Odyssey' to the present days of occasional Malay raids in the China seas, the ocean has been looked upon by lawless men as a sort of watery "no man's land." In the earlier days, piracy was almost respectable, but when the great nations of Europe began to depend on their foreign commerce, international law declared it a crime against all mankind. Death was the usual penalty when caught. But despite severe measures to repress them, pirates continued to flourish so long as they could find a place of refuge and a market for their stolen goods.

Decatur and the Pirates

The last great den of what may be called "pirates" on the Barbary coast of northern Africa was attacked by Stephen Decatur in command of a United States fleet in 1815, and their power was broken (*see* Decatur). These Barbary corsairs, as they were called, had been protected for centuries by the native rulers of these wild shores. Organized piracy today has been wiped out everywhere except on the coast and rivers of China, where pirate bands in sailing junks still plunder small craft when opportunity offers.

Among the best-known pirates, besides Captain Kidd (*see* Kidd, Captain William), was Captain Avery, who was put to death in 1696. His adventures are said to have inspired Defoe's 'Life, Adventure, and Piracies of Captain Singleton'. Another famous freebooter was Bartholemew Roberts, the nearest approach in history to the pirate of romance. He was killed in battle off the coast of Africa in 1722.

A sharp distinction must be drawn between pirate ships and "privateers." The former were never officially recognized by any civilized country, but the latter were for many years regarded as a legitimate part of the sea forces of the great nations. Although privateers, as their name indicates, were owned and operated by private citizens, they carried commissions known as "letters of marque" from their home government. Their duty under this commission was to attack the merchant ships or even the war vessels of the enemy. They received their reward in the vessels and merchandise they captured.

Privateering was abolished in Europe in 1856 by the Declaration of Paris. Although the United States, whose privateers had been so successful in the War of 1812, refused to sign this declaration, the old custom was abandoned in practice. Among the most famous privateers of history is Sir Francis Drake, one of the greatest of English sea-captains in the days of Queen Elizabeth. (*See* Drake, Sir Francis.)

PISA (*pē'zä*), **ITALY.** The "leaning tower" of Pisa has done more to make this city on the Arno famous than all its stirring history, its noted paintings, and its other great buildings. Constructed entirely of white marble, with walls 13 feet thick at the base, the eight-storied tower rises 179 feet, about the height of a 15-story building. At the top it is 16½ feet out of the perpendicular; in other words, a stone dropped from the lower side of the upper gallery would strike the ground 16½ feet from the wall at the bottom of the tower.

A stairway of 300 steps built in the walls leads to the top, where a magnificent view of the city and of the sea, six miles away, is unfolded. The tower, intended as a bell-tower for the nearby cathedral, was begun in 1174 and finished in 1350. The foundations were laid in sand and it started to tip after the first three galleries had been built, but the work went on with slightly changed plans. Some engineers refer to it as the "falling tower" of Pisa, for it has tipped an additional foot in the last century. The scientist Galileo, who was born in Pisa, used the tower in experiments to determine the velocity of falling bodies (*see* Galileo). In the same square as the tower are the famous Pisa cathedral and baptistery, which like the tower are fine examples of Romanesque architecture; and the ancient city walls and citadel add interest to the city.

Relics of the days when Pisa was a Roman colony are preserved, but the city did not gain great historical importance until the depredations of the Saracens in the 11th century. The inhabitants not only drove out this foe, but pursued him to Sicily and even to the shores of Africa. For some time afterward Pisa figured as a powerful and wealthy maritime city republic. It took an active part in the wars and politics of Italy for four centuries; at the height of its power, in the 12th century, it had a population of 150,000, a territory stretching along the coast from near Genoa almost to Rome, and dominion over Sardinia, Corsica, and the Balearic Islands.

THE LEANING TOWER AND CATHEDRAL OF PISA

The tower is one of the "Seven Wonders of the Modern World." For nearly six centuries it has been leaning away from the white marble cathedral. The view from its top, embracing the mountains and the sea, is superb.

Pisa's decline began with a defeat of the Pisan fleet by the Genoese in a great sea fight off Meloria (near Leghorn) in 1284. It was conquered by Florence in 1406, and thenceforth held in subjection by that state except for the brief period 1494–1509. Pisa was the scene of a great church council in 1409, which was called to settle rival claims to the papacy. As a part of the grand duchy of Tuscany, it was absorbed into the rising kingdom of Italy in 1859.

Commercially the town today has little importance. Cotton manufacture is the chief industry. It has a university, founded in 1338, which is still an important center of learning. Population, about 68,000.

PITCHER PLANTS. Some plants have turned insect catchers in order to supply themselves with nitrogenous food. The pitcher plants are the most noted of these. Many species of pitcher plants grow in tropical Asia and Borneo. They are climbers and pull themselves up over shrubs through a tendril formed by the midrib of the leaf extending beyond the tip. On many of these tendrils are developed wonderful little pitchers standing upright with lids that stand enticingly open. Each pitcher is a trap. It has a stout sleek rim, which is curved inward and contains glands that give forth a sweet juice attractive to insects. Below the rim the inside of the pitcher is very smooth, so that visiting insects falling over the rim slide down in spite of their efforts. In the lower part of the pitcher are glands that secrete digestive fluid, which partially fills the pitcher. The rim and the cover of the pitcher are blotched with red, to attract the insects which come eagerly to sip the sweets. These possibly act as intoxicants, since many usually wary insects fall into the fluid and are digested; for the plant literally eats them.

The pitcher plants of America, often called "side-saddle" plants, grow in swampy places, the leaves being arranged in a circle about the root. Each leaf is a pitcher with a broad flattened lid, in color green blotched with purple, the lid and the mouth being brighter colored. Each pitcher has a wing along the inner side, marking the "seam" where the edges of the leaf join to form the pitcher, and this wing has glands which secrete nectar; also the rim and the under side of the lid have similar glands. Thus a path of joy is prepared for the visiting insect, along which he may crawl up the side and over the edge. The inside of the pitcher is not only smooth but has downward-pointing hairs—so down the greedy visitor falls into the fluid at the bottom of the pitcher, where it is speedily drowned and decomposed. The manner in which the insects are actually digested and absorbed by the plant is not yet known. In California there is a huge pitcher plant that has pitchers three feet high. The side-saddle plant belongs to the genus *Sarracenia;* those with the pitchers at the tip of the tendrils belong to the genus *Nepenthes.* (For illustration *see* Plant Life. *See also* Sundew; Venus' Fly-Trap.)

PITT, WILLIAM, THE YOUNGER (1759–1806). "It's not a chip of the old block; it is the old block itself," enthusiastically exclaimed the orator and statesman Edmund Burke, after listening to the first speech in Parliament of William Pitt the younger, the second son of the great Earl of Chatham (*see* Chatham, William Pitt, Earl of). And when someone else declared that, "Pitt will be one of the first men in Parliament," the Whig leader, Charles James Fox, replied, "He is so already."

WILLIAM PITT, THE YOUNGER
Prime Minister of England at 24

All this praise was given to a young man only 21 years old, an age when many young men are still in college. But William Pitt had "an old head on young shoulders." Indeed, his friends used to say that he had never been a boy. He was born when his father's power was at its height, but along with that idolized father's abilities he inherited also his ill health. As a result he was such a delicate sickly boy that he was never sent to the great public schools, as were his brothers, but was taught at home by private tutors until he entered Cambridge University, at 14. But he had such great abilities and was so well taught that at the age of seven he surprised people with his knowledge. Every night at home his father would make him read Greek and Latin authors aloud, and to this practice was attributed his extraordinary readiness and fluency of speech.

William Pitt lived for politics. His chief amusement was to go to Westminster to hear his father speak. When his father was created Earl of Chatham, he is reported to have said, "I'm glad I'm not the oldest son, for I want to speak in the House of Commons as papa did." This wish was granted at the age of 21, as we have seen. At 23 he was chancellor of the exchequer, and at 24 he was prime minister of Great Britain—the youngest man who ever held that great office. For nearly a score of years in one of the most trying times in history he directed the affairs of his country—for 17 years in his first ministry (1783–1801), and two years in his second (1804–06).

During his first years in office Pitt reformed the finances of the kingdom and attempted to bring about other reforms. But before he could accomplish much the French Revolution broke out, and the time for internal reforms was past. Pitt kept England neutral as long as possible, but the excesses of the revolutionists so outraged the feelings of the English people that in 1793 peace became an impossibility.

For the rest of his life, except the three brief years (1801–04) when he was out of office because King George III would not support his measures to allay Irish discontent, Pitt had to struggle with problems arising from the great war with revolutionary France. He not only had to keep a strong fleet on the seas and an army on land, but he had also to provide money for England's allies on the Continent. His measures may not always have been the wisest ones, but it is doubtful if anyone else could have solved the many knotty problems so well.

At length the struggle proved too much for Pitt's frail body. Napoleon's victory at Austerlitz over England's allies, the Austrians and the Russians, proved his deathblow. Even the news of Nelson's great naval victory at Trafalgar, while it cheered him, could not postpone the end. He died on Jan. 23, 1806, less than two months after Austerlitz. A short time before his death he exclaimed, "Roll up the map of Europe. It will not be needed for another ten years." Equally memorable was this other saying: "Let us hope that England, having saved herself by her energy, may save Europe by her example." The saving of Europe from Napoleonic domination was in a large measure the work of William Pitt, one of the greatest prime ministers that Great Britain has ever had.

PITTSBURGH, PA. By good rights are Pittsburgh's skies red by night and murky by day, for it commands the Slaves of the Lamp—fire, the fuels that feed it, and the industries nourished by it. Here, where the Allegheny and the Monongahela rivers cleave the hills to meet and form the mighty Ohio, is one of the most magnificent city sites in the world, comparable to those of Edinburgh and Florence. Surrounded by lovely woodland and splendid bluffs, the seething city bursts the bonds with which the Y-shaped channel of the two source rivers would bind it, and spreads across to the farther banks—a dense mass of factories, mills, docks, and warehouses, gridironed with railroads, overhung with smoke, and resonant with the unceasing clangor of engines and machinery.

First the rivers, then the fuels with which the region abounds—first transportation, then power—made Pittsburgh a great city. Young George Washington, who visited the locality in 1753, saw the strategic importance of the site as the gateway to the West. But the French built Fort Duquesne there the next year, and it was not until 1758 that this post was reduced by the English and christened Fort Pitt, or Pittsburgh.

A great railway system has arisen to meet the city's needs—but unlike most American rivers, the three which meet here have not resigned their functions of transportation. Long processions of barges creep over the waters, bearing coal from northern West Virginia, a hundred miles away, to which the Monongahela gives access, and from upper western Pennsylvania, whose coal and oil fields are tapped by the Allegheny. The Ohio River opens the road to the Mississippi and the Gulf of Mexico—taking in

LOOKING INTO THE HEART OF THE CITY OF STEEL

On the site of old Fort Pitt, there has arisen what Bancroft called the " most enduring monument to William Pitt," named in his honor at the suggestion of George Washington. This photograph was taken from Mount Washington, looking north across the Monongahela River to the business section of Pittsburgh.

Cincinnati, St. Louis, and New Orleans on the way. The heavy freight of Pittsburgh by land and water combined amounts to 175,000,000 tons annually, more than that of any other city in the world—more in fact, than that of New York, London, Liverpool, and Marseilles combined.

Pittsburgh is a great manufacturing city because it is the focus of the largest and most productive coal field on the continent and of a highly productive oil field, and taps one of the richest gas fields in the world. Nearly one-half of the coke manufactured in the United States and about ten per cent of all the bituminous coal mined in the world come from the Pittsburgh district. Hundreds of miles of pipe bring natural gas from West Virginia and western Pennsylvania.

The "Smoky City" is also the "Iron City" and the "City of Steel" for it makes annually more pig iron and steel than any other city of the United States, and more steel rails, steel plates for ship-building, and pressed steel cars and coaches than any other city in the world. The structural steel industry originated here. Pittsburgh barbed wire served in the front trenches and helped to win the World War; Pittsburgh insulated wire plays a large part in the electrical industry. The aluminum industry had its rise out of experimental work by Pittsburgh men. All the metal industries, the production of both raw material and finished product, are of vast extent. Pittsburgh leads the world in the manufacture of plate glass, window glass, pressed table ware, bottles and lamp chimneys, and produces a high grade of optical glass. The largest cork factory in the world makes every cork product, from bottle stoppers to life preservers and floor-coverings. Chemicals (especially those derived from coal-tar), salt, fire-brick, and fire-clay, electrical and other machinery, and water-pipes and plumbers' supplies, are among the other Pittsburgh products.

Pittsburgh is the ninth city of the United States in size. Its people are of diversified origin, including large numbers of Italians, Germans, Poles, Hungarians, and Slovaks. It has many fine public buildings, parks, and other places of interest, a great Institute of Technology established by the gift of Andrew Carnegie, and the University of Pittsburgh, dating from 1787. Population, about 590,000.

PIUS, POPES. Ten popes have borne the name Pius. The earliest (PIUS I, 140–154) belonged to the period before Christianity was a tolerated religion in the Roman Empire; and the latest died a few weeks after the beginning of the terrible World War, in 1914.

PIUS II (pope, 1458–1464) was a well known "humanist" scholar and writer of the Renaissance, named Aeneas Sylvius Piccolomini. He was born at Siena and won his cardinalate by his services in bringing Germany back to the Roman obedience, after the schismatic Council of Basel (1431–1449) and its antipope Felix V. As pope he continued the patronage of learning and art begun by Nicholas V (1447–1455); but his chief efforts were directed to arousing Europe to a crusade against the Turks who had taken Constantinople in 1453. He died at Ancona, Italy, waiting for the fleet and armies which he vainly hoped would rally at his call. His letters and other literary works are important sources for the history of the time. PIUS III, who was pope for less than a year (in 1503), was a nephew of Pius II.

PIUS IV, 1559–1565, and PIUS V, 1566–1572, were both active in furthering the work of the Council of Trent and in checking the spread of Protestantism. PIUS VI, 1775–1799, and PIUS VII, 1800–1823, belonged to the period of the upheaval caused by the French Revolution and Napoleon Bonaparte. PIUS VIII, 1829–1830, lived too short a time after his election to accomplish anything.

PIUS IX, 1846–1878, was perhaps the most memorable pope of this name, alike because of his long pontificate, his early liberalism in politics (until checked by Mazzini's attempt to establish a republic in Rome, in 1849), the stern reaction in the papal government which followed under Cardinal Antonelli, and the loss of the temporal power of the papacy in 1871, when Rome was by force made the capital of the new kingdom of Italy. Pius IX thereupon established the policy by which the pope confined himself to the Vatican Palace and its surroundings, and refused recognition to the Italian king. In 1854 Pius IX issued a bill establishing as a doctrine of the church the dogma of the Immaculate Conception of the Virgin Mary. The Vatican Council, held by him in 1869–70, further proclaimed as a necessary part of the Catholic faith the doctrine of the pope's infallibility when acting officially on matters of faith and morals.

PIUS X, 1903–1914, was born of humble parents, his father being a postman near Venice. After becoming a priest, at the age of 23, he rose to be bishop of Mantua, was made a cardinal in 1893, and shortly afterward became Patriarch (archbishop) of Venice. He was free from ambition and filled with a passion for souls, and had a gift for organization. His schools and his work for religious societies made him known throughout Italy. He was ardent for missions and preaching. His rule as pontiff was marked by his abolition of the veto of Austria, France, and Spain on the election of the pope; and by his stanch advocacy of the Gregorian chant and opposition to secular music in the services of the church. In his pontificate came the laws in France decreeing the complete separation of church and state. When the World War came, Pius X issued (Aug. 19, 1914) an ineffectual appeal for peace, and his death at the age of 79 is said to have been hastened by grief at the calamity which swept over Europe.

PIZARRO (*pĭ-zăr'ō*), FRANCISCO (about 1471–1541). The story of the conquest of Peru by an obscure adventurer forms one of the most dramatic episodes in the history of the New World. At the age of 50 Pizarro was a captain of infantry on the Isthmus of Panama, with nothing to show for years of toil and peril but a small holding of land. In little more than a decade he had conquered the fabulously wealthy empire of the Incas, and had bestowed on Spain the richest of her possessions in the Americas. Violence and perfidy were the instruments with which he worked, and by violence and perfidy he came to his death. Resolute and daring to the last degree, he was infinitely greedy and merciless, and the sufferings of the peaceful natives of Peru at his hands are one of the saddest chapters in history.

In extenuation of Pizarro's crimes it must be remembered that his early days were cast in dark places. He was the illegitimate son of a Spanish colonel, and was left to grow up without care. To the end of his days he was never able to write his name, and tradition says that his youth was spent as a swineherd. Some time before 1510 he sailed to seek his fortune in the recently discovered New World. After accompanying Balboa in the journey that resulted in the discovery of the Pacific Ocean (1513), he became a cattle farmer. Then reports reached him of a vast and wealthy empire to the south. Pizarro's imagination was kindled and he sought the aid of two friends in equipping an expedition for its conquest. His associates were another soldier named Diego de Almagro, who was to equip the expedition, and vicar of Panama, Hernando de Luque, who was to furnish the funds. The three men entered into a famous written agreement, dividing equally the spoils of the empire they hoped to master. A first expedition resulted in disaster, after two years of suffering and hardship. A second expedition in 1526 fared little better. The adventurers found they were too few for the task, and Almagro was sent back to Panama for reinforcements, while Pizarro and part of the force remained on an island. But the governor of Panama was not inclined to support the enterprise, and sent vessels to bring back Pizarro and his men. Pizarro refused to return, and, drawing a line on the sand, called upon all the men who wished to remain and share in his enterprise to come over to his side. Thirteen men crossed the line, but the others returned. Soon after this the governor was induced to send one vessel to Pizarro, with which he explored the coast of Peru and collected information concerning the empire of the Incas.

The Conquest of Peru

Discouraged at the indifference of the governor, Pizarro returned and sailed to Spain, where he applied for authority to undertake the conquest of Peru. A commission was given him for his enterprise, and he sailed from Spain on Jan. 19, 1530, and from Panama the following year, with three vessels, containing fewer than 200 men and about 40 horses.

After seven years of hardship and disappointment the adventurers were now embarked on the actual conquest of Peru. After a year spent in the subjugation of the coast settlements, Pizarro marched inland to the city of Cajamarca, where he captured Atahualpa, the Inca emperor, by one of the treacherous acts for which he was noted. Fearlessly accepting the invitation of the Spanish commander to visit him, Atahualpa, attended by crowds of his unarmed followers, arrived at the camp. At a signal Pizarro and his men seized the Inca emperor, and the rest of the Spaniards fell on the Indians and slaughtered 2,000 of them. Atahualpa offered, by way of ransom, to fill with gold a room 22 feet long and 17 feet wide to a point as high as a man could reach, and to fill it twice over with silver. Pizarro accepted the offer, received the precious metal, estimated at more than $15,000,000, and soon after had Atahualpa murdered.

The End of Almagro and Pizarro

Pizarro then marched to Cuzco, and set up the young Inca, Manco, as nominal sovereign. In 1535 he founded Lima, the present capital of Peru, as the capital of his new government. Two or three years later a fierce quarrel arose between Pizarro and Almagro concerning the territory each was to govern. This contest assumed the proportions of a civil war and resulted in the capture and execution of Almagro. But the embittered and discontented followers of Almagro conspired against Pizarro and finally assassinated him on June 26, 1541. In a glass case in the Cathedral of Lima are a pile of moldering bones, said to be those of the pitiless conqueror of Peru. (*See* also Incas; Peru; South America.)

CHILDREN of the SUN—The Earth's Sister Planets

LOOKING up at the heavens, night after night, we observe stars that seem to move about in a peculiar fashion, apparently not controlled by the same laws which rule the rest of the heavenly bodies. The Greeks thought their motions so unusual that they called these stars "wanderers" or "Planets," and that is the name by which we know them today. They are sisters to our Earth and children of the Sun, about which they revolve. If we picture the Sun as a ball nine feet across, the Earth—a 21-inch speck—would be 330 yards from the Sun, and Neptune, the outermost of the Planets, 10,000 yards; the nearest Fixed Star would then be 40,000 miles away! This gives some idea of the unfathomable distances of cold lifeless space which separate our Planetary System from the rest of the Universe.

PLANETS. Strictly speaking, planets are not "stars" at all. The fixed stars are vast burning bodies like our own Sun, only infinitely farther away. They shine like little points of light, instead of balls of fire, as they really are, because of their immense distance. The planets, on the other hand, belong to our solar system, of which the Earth is one member, circling about the Sun. They shine, not by their own light, but by the reflected light of the Sun. It is because the planets each move at different rates of speed, and in orbits at varying distances from the Sun, that they seem to "wander" through the sky. But they follow laws as unchangeable as those which govern the stars. If any worlds besides the Earth are inhabited, those worlds are probably the planets. Of all the celestial bodies they are the only ones in which conditions seem at all favorable for the development of life such as we know it on the Earth.

Very early in history the planets came to be regarded with superstitious awe, and astrologers professed to cast horoscopes and predict the future on the basis of planetary movements. From time to time we still hear dire predictions that on such and such a day the world is going to be destroyed in a great celestial catastrophe caused by the planets. In 1919 ignorant people all over the world were panic stricken for fear disaster of this kind would occur on December 17 of that year. The prediction was based on the fact that on the date in question all of the planets would be in positions which were nearly in a straight line. But while the phenomenon was unusual, there was nothing "unnatural" about it. In the history of the solar system the planets had assumed similar positions many times before, as they will do many times again.

The eight chief planets, in the order of their distance from the Sun, are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. They all revolve from west to east, or counter-clockwise. Mercury and Venus are called the "inferior" planets, because they lie between the Earth and the Sun, while the outer planets—Mars, Jupiter, Saturn, Uranus, and Neptune—are classified as "superior." The inferior planets move about the Sun faster than the Earth, while the superior planets move more slowly. In addition there are several hundred small bodies called "asteroids" revolving about the Sun in the wide gap between Mars and Jupiter (*see* Asteroids).

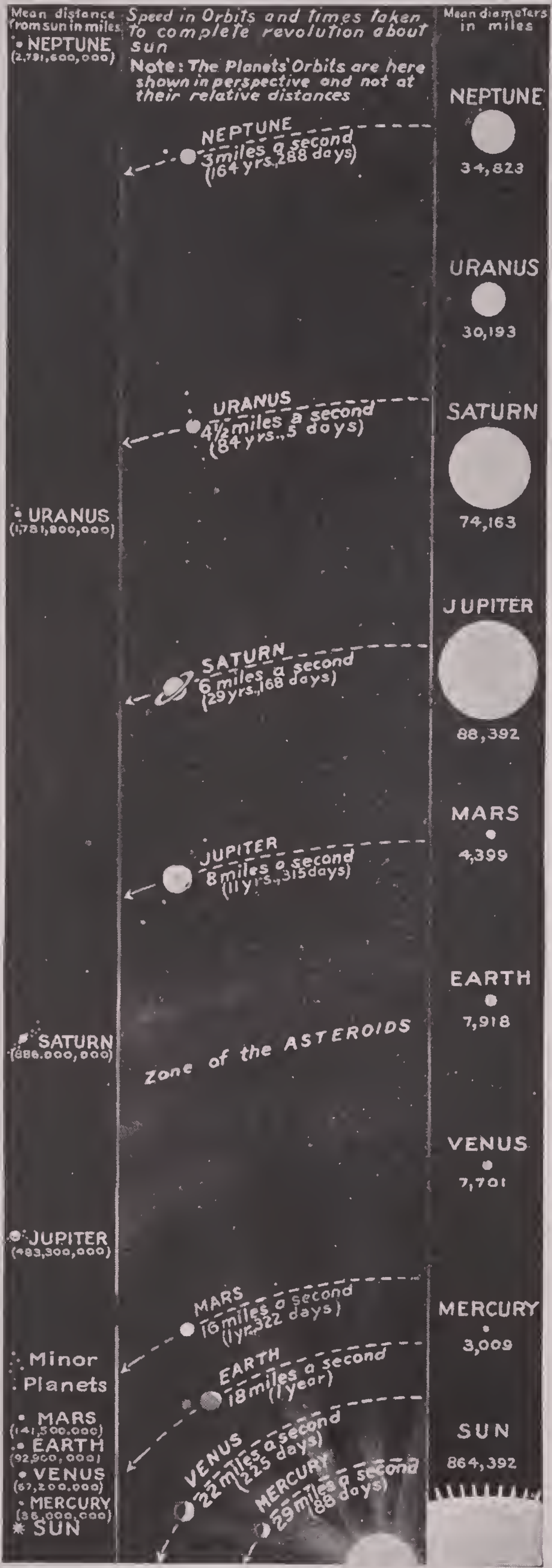
Sir Isaac Newton first proved that every planet is acted on by a force emanating from the Sun, and he also proved that this force had a measurable relation to the distance of each planet from the sun. For instance, the speed with which the planets move in their orbits, as shown in the chart on this page, varies so that the farther the planet is from the sun, the slower its motion.

There is still much to be learned, however, about the revolution of the planets on their own axes. We know that it takes the earth 24 hours to revolve once on its axis, to complete a day, but the length of the day on Mercury, Venus, Uranus, and Neptune is still unmeasured. In fact, it is doubtful if Venus revolves at all on its own axis. A day on Mars is 24 hours, 37 minutes; on Jupiter, 9 hours, 55 minutes; on Saturn, 10 hours, 14 minutes.

While all the planets belong to the same family, they are by no means all alike. Some are smaller than the Earth and some are hundreds of times larger. Some are very hot, and some are very cold. Some have scarcely any atmosphere (that is, what we call "air") and some have little or no water.

Mercury, although the nearest planet to the Sun, is still 36,000,000 miles away from that body. It has a diameter of 3,009 miles, or less than half that of the Earth, but its density is 0.63—that is, it is less than two-thirds as "solid" as the Earth. Its surface gravity is only thirty-one hundredths that of the earth, which means that an object weighing 100 pounds on this planet would weigh only 31 pounds on Mercury. Finally, a year on Mercury is only 88 earth-days long.

FACTS ABOUT THE PLANETS


Mean distance from sun in miles
NEPTUNE (2,791,600,000)
URANUS (1,781,900,000)
SATURN (886.000,000)
JUPITER (483,300,000)
Minor Planets
MARS (141,500,000)
EARTH (92,900,000)
VENUS (67,200,000)
MERCURY (36,000,000)
SUN
Speed in Orbits and times taken to complete revolution about sun
Note: The Planets' Orbits are here shown in perspective and not at their relative distances
NEPTUNE 3 miles a second (164 yrs., 288 days)
URANUS 4½ miles a second (84 yrs., 5 days)
SATURN 6 miles a second (29 yrs., 168 days)
JUPITER 8 miles a second (11 yrs., 315 days)
Zone of the ASTEROIDS
MARS 16 miles a second (1 yr., 322 days)
EARTH 18 miles a second (1 year)
VENUS 22 miles a second (225 days)
MERCURY 29 miles a second (88 days)
Mean diameters in miles
NEPTUNE 34,823
URANUS 30,193
SATURN 74,163
JUPITER 88,392
MARS 4,399
EARTH 7,918
VENUS 7,701
MERCURY 3,009
SUN 864,392

From these diagrams it is clear how insignificant a part of the solar system the Earth really is. Imagine the Sun surrounded by a belt; from that belt you could hang 342 Earths side by side without crowding.

The conditions vary so much on the different planets that some scientists believe that the Earth is the only body that can possibly be inhabited. Strong evidence, however, has been brought forward to support the theory that animal and vegetable life of some sort exists on Venus and Mars.

Professor Percival Lowell has become world famous for his theory that Mars is inhabited by beings of a very high degree of intelligence, although they would not necessarily have the forms of human beings. Indeed, the novelist, H. G. Wells, in his book 'The War of the Worlds', imagines them in the form of very intelligent cuttlefish! However this may be, Professor Lowell finds on that planet a vast network of canals, which he takes as proof that the inhabitants are not only highly intelligent, but that they are engaged in a life-and-death struggle against extinction for lack of water. The purpose of the canals, he believes, is to draw water from the melting snow at the poles, and he explains the surface markings which can be seen through the telescope as being strips of vegetation, 20 or more miles wide, which grow in the irrigated regions. Many astronomers, however, have been unable to see these markings with anything like the distinctness which appears on Professor Lowell's maps, and are far from being convinced.

Whatever the truth, it is certain that life on Mars would be very strange and very different from what it is on Earth. The planet

HOW THE HEAVENS WOULD LOOK IF WE LIVED ON SATURN

Suppose we moved New York City to Saturn, and then looked up at the heavens from our new home. The most startling change would be the appearance of Saturn's rings, like an immense arch extending round the heavens. Then Jupiter would be our nearest neighbor among the planets, and Mars, Venus, and the Earth would seem like little stars, a few hundred million miles away. And instead of one moon, we should see ten, of various sizes, for Saturn has more satellites than any other planet.

is only about half the size of the Earth, and an athlete who could jump six feet high on the Earth could jump 16 feet on Mars, because the surface gravity is so much less. If he got on a pair of Martian scales he would probably doubt his senses, for if his ordinary weight was 150 pounds he would find that it had shrunk to about 54. Summer and winter on Mars are nearly twice as long as they are here, and the average temperature is probably below zero, though during the long summer it may go above freezing. Seen from the Earth, Mars has a ruddy appearance, probably due to its great deserts.

Conditions on Venus are more nearly like those on the Earth. It is very nearly the twin of the Earth in size, and it probably has the same kind of atmosphere. The great unsolved question about Venus is whether daylight and darkness succeed each other as they do on Earth, or whether one-half of the planet is in perpetual daylight and the other half in perpetual darkness. In any event the heat must be intense, because of the comparative nearness to the sun. On the other hand, there is plenty of moisture and an abundance of everything necessary to sustain life in tropical splendor. Because of this abundance, the Swedish astronomer Arrhenius believes that life on Venus has reached only a primitive state; he thinks hardship and struggle are necessary to develop civilization just as they often seem necessary to develop the individual.

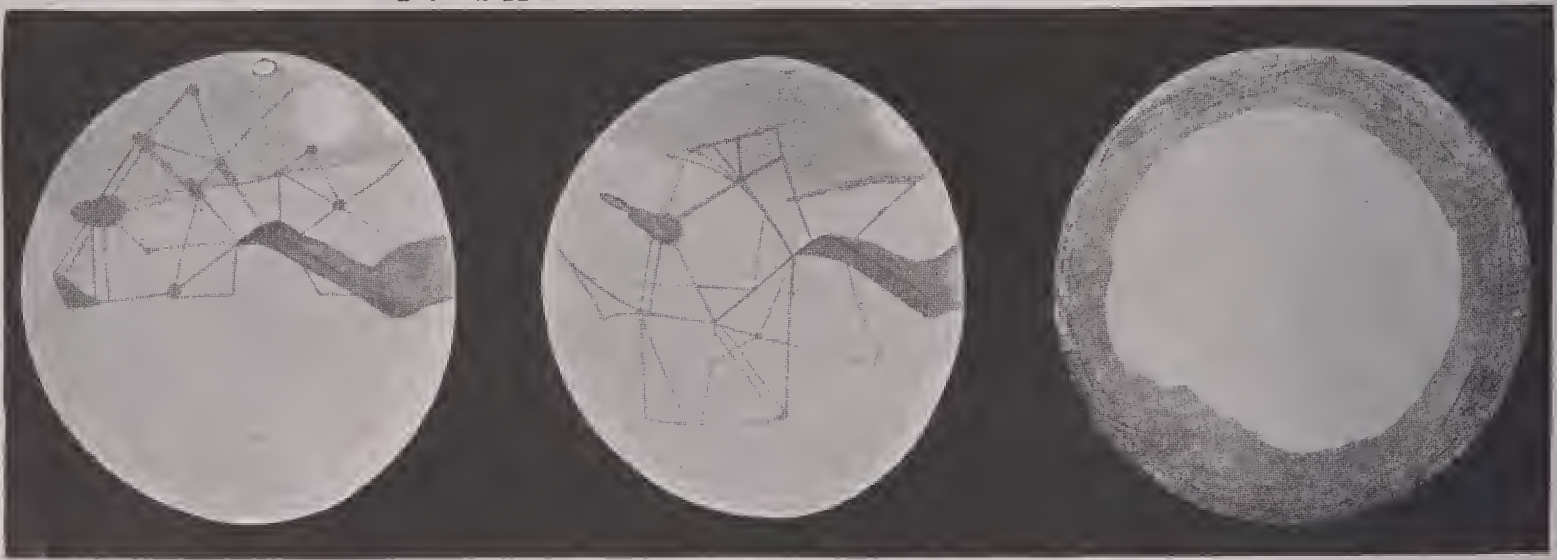
Saturn's Wonderful Rings of Light

The other planets are not believed to be inhabited even by low forms of life, but they are no less interesting to the astronomer. As viewed through the telescope, Saturn, with its wonderful rings, is one of the most curious and superb sights in the heavens. (*See* illustration on page 243.) The early astronomers were entirely mystified, but today we know that these rings are not continuous masses of matter, but are composed of swarms of dustlike meteors revolving about the planet. The three (perhaps only two) rings are of enormous circumference; from the inner edge of the innermost to the outer edge of the outermost is a distance of 42,200 miles, or more than half the diameter of the planet itself. On the other hand the rings are enormously thin, probably between 15 and 25 miles. About every 15 years (1907, 1922, 1937, etc.) Saturn's path brings it in such position that its rings are presented edgewise to the Earth. They are then found to be so thin that they can hardly be seen even in the most powerful telescope.

Saturn is an enormous globe, equivalent to about 719 worlds like the Earth, rolled into one. Jupiter is still larger and it is the greatest of the planets. If Mercury, Venus, the Earth, and Mars were placed edge to edge, they would represent only a little more than a quarter of Jupiter's diameter. Traveling at the rate of 25 miles a day, it would take a man on a bicycle about 30 years and three months to go around Jupiter, while he could make the trip around the Earth in about two years and nine months. A man who weighs 150 pounds on the Earth would weigh nearly 400 pounds on Jupiter, and his bicycle would have to be increased correspondingly in strength.

Another odd thing would happen on Jupiter. Even if you were 80 years old on Jupiter, you would not yet

IS THERE ANY LIFE ON MARS?



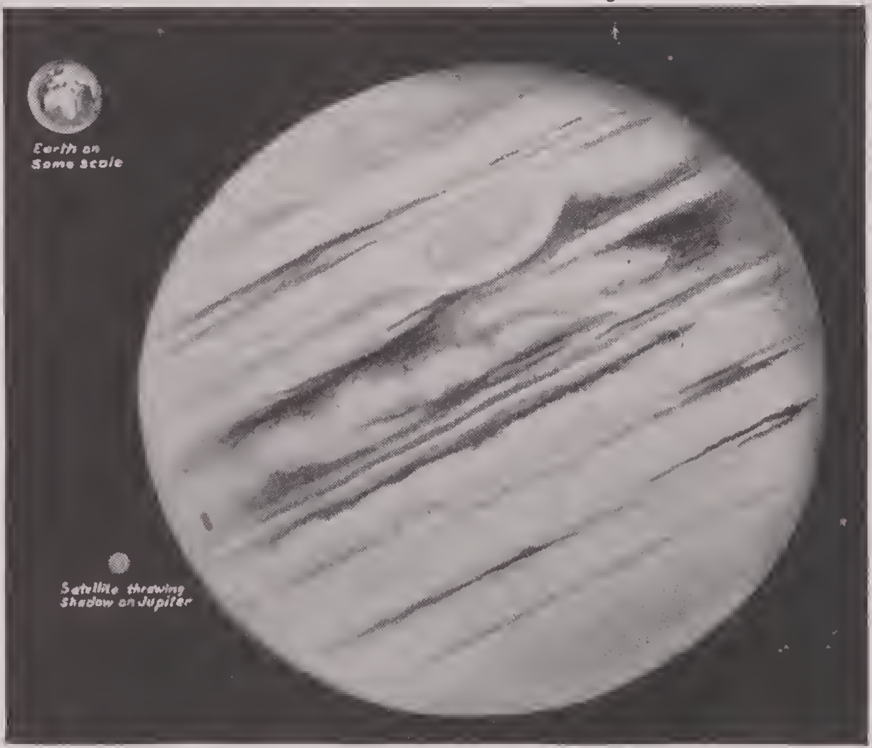
What are people doing on Mars? Or is there anybody there to be doing anything? Astronomers are still debating these questions. One famous student of the heavens believes that in the first two pictures we are looking at a network of canals built by the inhabitants of Mars for the purpose of carrying water from the melting snows at the poles. The picture at the right, he thinks, shows the vast extent of the ice cap around the south pole of Mars during the winter.

have attained your seventh birthday, according to the measurement of time on that planet. The reason is that Jupiter's year, or its period of revolution around the sun, is equal to nearly 12 of ours.

Through the telescope we see that Jupiter has a number of strange markings consisting of a series of dark and bright belts. Dark spots also appear from time to time, which gradually turn red and finally vanish. What we observe are probably clouds of vapor or gases thrown out from hot internal fires. So the man on the bicycle wouldn't have a chance to make his trip after all, for he would find the surface altogether too hot and unstable for safety and comfort.

It is probable that Jupiter is in an early stage of evolution. Looked at this way, Mercury, the smallest of the planets and the one nearest the sun, is old; Mars is middle-aged; and Jupiter is still comparatively young.

WEATHER BULLETIN FROM JUPITER!


Earth on Same scale
Satellite throwing Shadow on Jupiter

They're having an awful time up on Jupiter, according to this telescopic picture, for those darker masses are immense belts of clouds, many thousands of miles across.

How Uranus and Neptune were Discovered

Uranus and Neptune, by far the most distant of the planets, were not discovered till after the invention of the telescope, and Neptune is never visible to the naked eye. Uranus was discovered by Sir William Herschel in 1781. The discovery of Neptune was one of the most brilliant achievements in astronomy. Observations of Uranus showed certain discrepancies in its motion; in other words, its actual position varied slightly from the one which theory showed it ought to have. The suggestion was then made that these discrepancies might be the result of the attraction of an unknown planet. A young Englishman, Adams, and a young Frenchman, Leverrier, started to work on the problem, using nothing but mathematics and the laws of motion and gravitation. Leverrier sent his conclusions to the astronomer Galle, in Berlin, and on the first evening after receiving Leverrier's letter (Sept. 23, 1846) Galle discovered the planet at the exact place where the French scientist had predicted it would be.

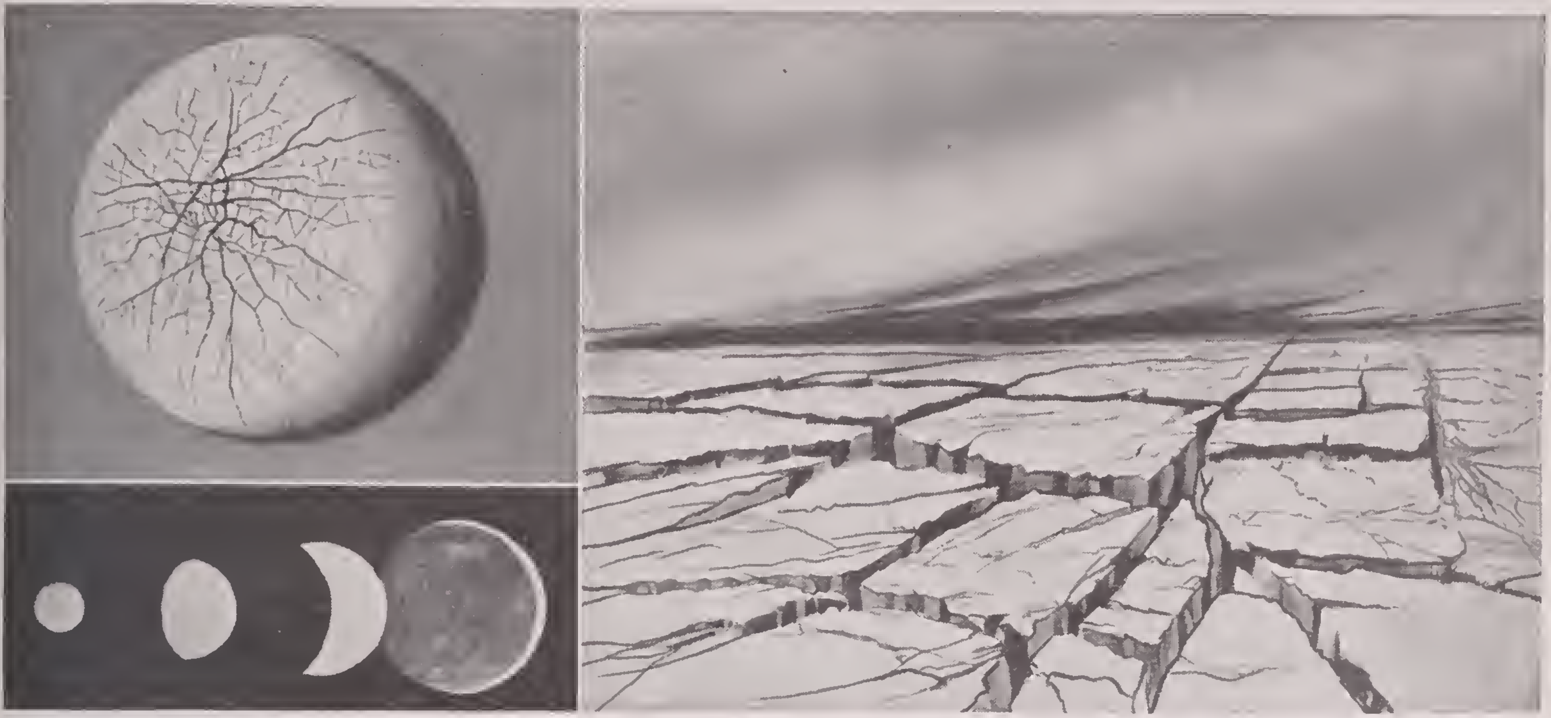
Because of their great distance, comparatively little is known of Uranus and Neptune. They are probably in an early state of evolution like Saturn and Jupiter.

With the exception of Mercury and Venus, all the planets have satellites (or moons) which circle about them just as our Moon does about the Earth. Mars has two, which are very small; Jupiter has nine; Saturn ten; Uranus four; and Neptune one.

How were the Planets Formed?

At the close of the 18th century (1796) the French astronomer Laplace advanced what is known as the "nebular hypothesis" as a possible explanation of the

THE STRANGE CLIMATE OF THE PLANET VENUS



Venus, the goddess of beauty, would not have felt flattered had she known that this planet was to be named for her. For one half of it is supposed by some astronomers to be a desert of sunbaked rock. This idea is based on their belief that Venus revolves on its axis only once a year, thus always presenting the same face to the sun. The great difficulty in finding out the exact truth about Venus and her ways is that when Venus is nearest to the earth so little of her can be seen. The picture in the lower corner shows the phases of Venus as we see them—only a thin crescent being visible when the planet is nearest to us.

way in which the planets were formed. All the matter which now makes up the solar system, he suggested, was once a vast glowing mass of hot vapor or gas, resembling one of the gigantic nebulae which we may still see through the telescope (*see* Nebulae). As it cooled and contracted this mass began to rotate ever more and more rapidly, until a series of rings like those of Saturn were thrown off and left behind. These rings then condensed into the planets. The Earth itself, according to Laplace, was at first such a flaming mass of gaseous matter, which slowly solidified, although it long remained very hot. The outer crust cooled, but the inner mass still retained a high temperature. Gases were thrown off to form an atmosphere, which in turn poured down water on the surface of the Earth. Cooling and contraction of the interior caused the crust to wrinkle, thus forming the mountains; and a comparison was often made between the wrinkled skin of a baked apple and the wrinkled crust of the Earth.

Today astronomers generally reject this hypothesis. Among many other things, it fails to explain why Phobos, one of the satellites of Mars, revolves three times around that planet while Mars itself is rotating once. Nor does it explain why two of Jupiter's satellites revolve from east to west, while the other seven revolve from west to east. Finally, if the nebular hypothesis is correct, we should expect the outer planets, such as Neptune and Jupiter, to be older in development than the earth and the other inner planets, because, according to the theory, they were thrown off first. But the exact contrary seems to be true.

The best explanation reached thus far of the origin of the planets is the "planetesimal theory," which entirely discards the idea of ejected rings. This theory starts with a central mass, which eventually became the sun, and innumerable small bodies called "planetesimals," circling largely in one direction in one plane. In the course of their travels around the sun some of these planetesimals grew larger and larger by sweeping up all the material in their path, including the smaller planetesimals. Growth continued in this fashion until they became planets as they exist today.

Thus we conceive of the Earth as having grown from a very small amount of matter to the great globe upon which we live. When it was much smaller it had no atmosphere and no internal heat. But as it grew it collected an atmosphere and the great pressure of its increased weight caused the interior to become intensely hot. Because the Moon is comparatively small, it has little or no heat, except that which it receives from the sun, and for the same reason it probably cannot hold or attract an atmosphere.

According to the planetesimal theory, the process of growth, so far as relates to the solar system, is practically finished. The Earth and other planets still "capture" meteors and meteorites, but in relatively small quantitites. Therefore, it is supposed the solar system will remain in much the same condition it is at present, if the Sun continues to endure.

The planetesimal theory has the advantage that it explains most of the difficulties which arose in connection with the nebular hypothesis. Nevertheless, no entirely satisfactory explanation has been made of how the matter originally composing the solar system came to have a "planetesimal" form. There is some evidence, however, that the spiral nebulae which we can observe through the telescope represent other solar systems in a similar stage of development.

OUR PLANT BROTHERS — THEIR STRANGE HABITS and FORMS

THE story that plants tell is one of the most wonderful tales in the world. You may learn it from the tiny radish and from the mighty sequoia, from the brown seaweed in its salty home and the brilliant orchid in the tropical jungle. Parts of the story come from the lichens and mosses of frozen Siberia, and parts are whispered to men as they cut their way through the tangled masses of the Congo forests. Some of the secrets are hidden in the soft body of the fairy mushroom, and some in the iron-hard fruit of the ivory palm. Whole chapters can be read only through the microscope—the adventures of the yeast plant, for instance, that raises our bread, and the terrible work of the bacteria of disease. This never-ending story, with all its fascinating details, awaits those who know the simple language of the plants—a language that has leaves and flowers, roots and stems, colors and smells, strange shapes and habits for its alphabet. The study of plant life carries us into the wide realms of Nature—into the fields and woods, the mountains, seas, and deserts, of all lands. It also takes us into the libraries and laboratories of Science, where highly trained botanists grow plants, classify them, cut sections, and peer through powerful microscopes; and so spend weeks, and even years, in studying the structure and life habits of these brothers of ours of the Vegetable Kingdom.

PLANT LIFE. The first thing to keep in mind about plants is that they are *alive.* They eat and drink, they breathe and move, they rest and sleep, they are born and die, very much like men and animals. Most of them "see" after their own fashion, and many have exceedingly sensitive reactions to touch and other stimuli. They grow strong and healthy with plenty of good food, but get sick and pine away if the food is bad or scarce.

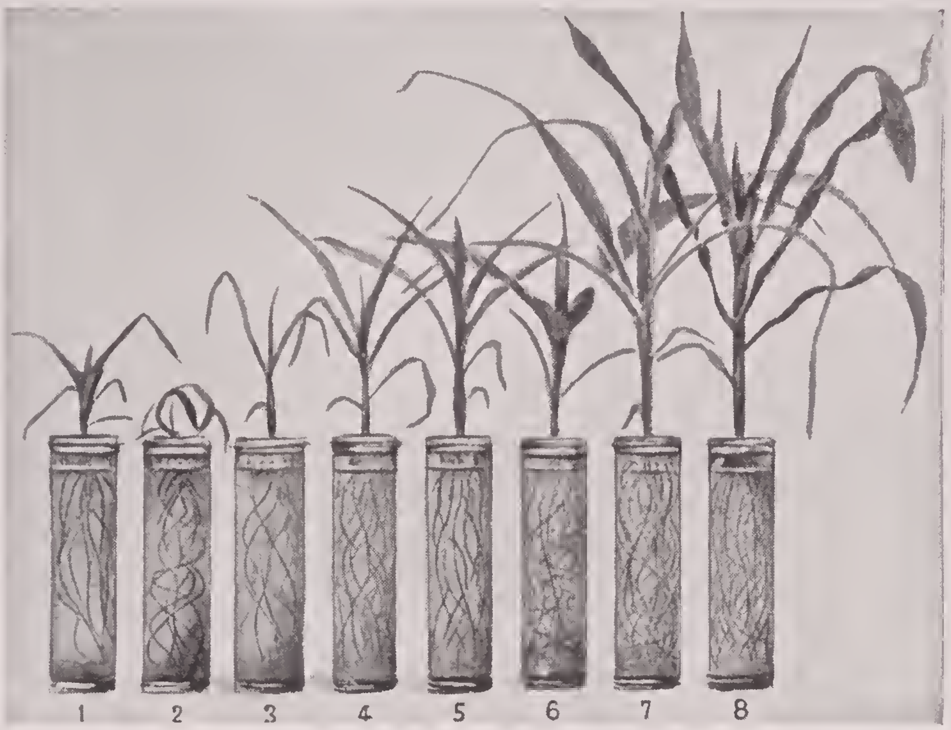
Though at first the life of a plant may seem exceedingly dull, sluggish, and uninteresting, we soon find out, if we learn the plant language, that they have many exciting adventures, hairbreadth escapes, tragedies, and triumphs in the round of their existence. Every tree, every flower, every bit of moss or fungus you see growing so quietly in Nature's wilds is a hero—surviving champion of a struggle against countless obstacles, powerful enemies, and continual dangers. The story of this struggle, of the many ingenious ways in which plants outwit their foes, overcome the obstacles that beset them, and keep their race alive in the midst of perils—this is the story of plant life.

There is hardly a place on earth where plants have not found a home. On the northernmost coast of Greenland, the Arctic poppy peeps out from beneath the ice-cap; and on the dismal reaches of the Antarctic continent, tussock grass and mosses grow wherever a bit of soil is exposed. On the summits of great mountains, buds and blossoms force their way up through eternal snows. In the heart of the burning deserts, the aloes and the cactus find a way to live. Oceans, rivers, and lakes are filled with an infinite variety of water plants; swamp lands teem with vegetation; and those regions where the plow and the ax have not been at work are mostly covered with great forests or seas of waving grasses. Finally, in the fields and gardens set apart from the "law of the wild," specially selected plants—the aristocracy of the vegetable kingdom—grow fat and multiply under man's guidance.

King Solomon, the Bible tells us, "spake of trees, from the cedar that is in Lebanon even unto the hyssop that springeth out of the wall." But if the "wisest of men" were alive today, it would tax even his brain to keep track of the enormous number of plants that have become known to science. Less than 200 kinds are mentioned in the entire Scriptures, but modern botanists have already recognized and named more than 250,000 plant species. And among these are some that King Solomon would not have recognized as plants at all; and others of whose existence he could never have dreamed, though they filled the air and the soil about him even as he spoke. Who in those days would have imagined, for instance, that the "leaven" which was used to raise bread, and which the Hebrews had carried with them out of Egypt, consisted of colonies of yeast plants, too tiny for the eye to see—so tiny indeed that their germs float about on every draft of wind? What would have been the great king's surprise if he had been told that in his own body were similar microscopic plants—the bacteria, some of which were his friends and some his deadly enemies?

But we cannot criticize the ancients for their lack of knowledge on these points: for it was not until the second half of the 19th century, when the high-powered microscope had come to the aid of the scientist, that he recognized how much broader were the boundaries of the vegetable kingdom than they had before been imagined.

WHY PLANTS GET SICK



Plants like human beings have to have certain minerals in their diet, if they are to grow and keep healthy. These are taken up with the water which the roots draw from the soil. Although these minerals are used in very small quantities, they are absolutely essential, as this picture shows. In each of the water jars is a corn plant. They were all started at the same time. But No. 1 lacked all minerals; No. 2 lacked potassium; No. 3, calcium; No. 4, nitrogen; No. 5, phosphorus; No. 6, magnesium; No. 7, iron; while No. 8 had all the required minerals.

FOOD STEALERS OF THE PLANT WORLD

This picture shows three outlaws of the plant world. Instead of making food for themselves from the air and soil, they steal it ready-made from more industrious plants. Their white color betrays their character, for it results from an absence of "chlorophyll," the green substance which honest plants use in food-making. The right- and left-hand plants are Fungi, while in the middle is the "Indian Pipe," one of the very few flowering plants which have no chlorophyll.

Added to this was the problem—which has not been entirely solved even today—of distinguishing exactly between the lowest forms of plants and the lowest forms of animals. What are the "slime-molds," for instance, which creep as white films over damp rotting wood in dark places—plants or animals? Scientists themselves disagree on the answer to this question (*see* Animal Kingdom).

The next step upward, however, brings us well inside the gates of plantdom. Here we find a great group called the *algae*, from which all other plants are believed to have evolved. These are water-dwellers as a rule, though some have learned to live in moist places in the open air. The algae include thousands of varieties, from the tiny diatoms with their microscopic but beautifully shaped flinty shells, to the giant kelp of the Pacific, which sometimes measures more than 150 feet from base to tip. The redness of the Red Sea is caused by certain tiny forms of algae, as well as the "red snow" reported by Arctic explorers. More familiar types of these plants form the green "scum" which gathers on the surface of still waters, and those netlike masses of green which wave from their moorings on stones at the bottom of slow-moving brooks (*see* Algae).

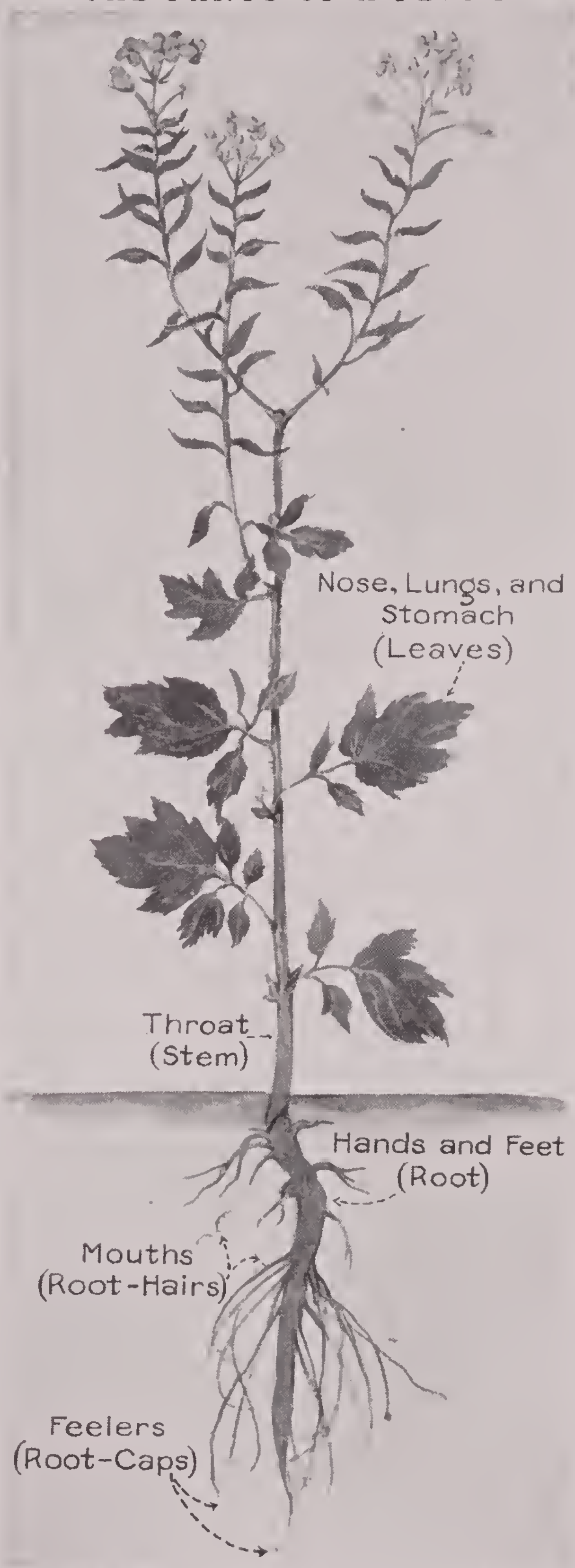
And then we come to the great group of the *fungi*. These are the "black sheep" of the vegetable kingdom—the outlaws, so to speak. For, although many of them are among the most useful of living things, others are exceedingly harmful—and none of them are governed by regular plant rules. You will know them by their names—the bacteria, the yeasts, the molds, the mildews, the blights, the rots, the rusts, the smuts, the mushrooms and toadstools, the black-knots, the bracket-fungi, and the like (*see* Fungi).

Next in order are the *mosses*, the living carpets of the woods, nature's own upholstery. It may come as a surprise to those who think "moss is just moss" that about 17,000 kinds have already been recognized and named, with probably many more to come. Many interesting things about these "tiny forests of fairy trees" are told in the article on Moss, particularly the extraordinary manner in which they multiply.

The plants which come next in order you will also find in the shaded woods and on the edges of quiet waters. They are the *fern plants*, which include not only the true ferns, with their delicate and beautiful fronds, but the horsetails and the clubmosses also. Most of the members of this group have learned to rear themselves above the ground and to stand alone. In fact, when that lesson was learned, millions of years ago, the ferns became the largest of plants, and covered the earth in vast forests, the remains of which form the great coal-beds in the earth today. Although some of the ferns at present grow as big as small trees, the group as a whole has fallen off in size and importance (*see* Ferns).

The last and greatest group includes all the other plants in the world, distinguished by the name of *flowering plants* or *seed plants*. These range in size from the duckweed, no bigger than the head of a pin, to the great eucalyptus of Australia, and the giant sequoia of California, the tallest of all trees. This group contains also more members than all the other plant groups put together, and shows the greatest variety of form and habit. The algae, fungi, mosses, and ferns reproduce themselves either by "fission," which means that one individual plant splits into two new individual plants, by some process of "spore" formation, or by some relatively simple form of the sex act. The flowering or seed plants, on the other hand, multiply generally, as their name would indicate, by the flower and seed method. (*See* Flowers; Seeds and Spores.)

THE PARTS OF A PLANT



Here we see the "organs" of a typical plant and the work they do. Let's begin at the roots. The main roots grip the ground and hold the plant in place, while the root caps feel their way through the soil in search of moisture. The root hairs draw in this moisture and the minerals it contains, and send them up through the "arteries," which lie beneath the water-proof "skin" of the plant, to the leaves. The leaves not only "breathe in" oxygen from the air but also the major part of the plant's food (carbon dioxide) and digest it with the aid of the water and minerals. The whole structure is held together by the fibrous "skeleton" of stem and branches.

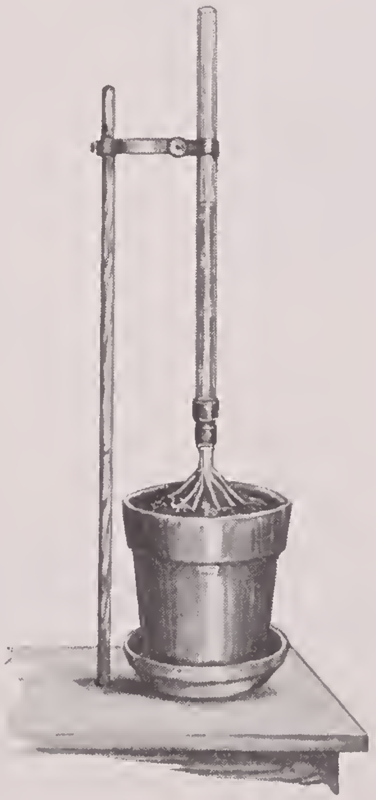
FEATS OF STRENGTH THAT NO ANIMAL COULD PERFORM

Who can call plants feeble, when even mushrooms can burst their way through pavements, and trees can split great bowlders? This power of expansion is due to growth and the internal pressure of the sap created, in part at least, by "osmosis." Below is a ripe tomato, burst open by the pressure of sap.

Now that we have made this brief survey of the vegetable world, what quality do we find common to all plants which serves to distinguish them from animals? Is it that they are stationary creatures, incapable of moving from place to place? Obviously not, for there are many water plants that float about freely, and certain low plant forms are even capable of swimming about quite actively. No, there is no single quality or mark that stamps all plants, even if we leave out these primitive types, which, as we noted, are so difficult to distinguish from primitive animals.

There is, however, one fundamental plant law—a law which, like so many other laws, is sometimes broken, but which is nevertheless the very foundation and constitution of the plant kingdom. This is the *law of greenness.*

Of course, you do not need to be told that the vast majority of plants are green. Since the beginning of history poets have sung of the beauty of "earth's green mantle," and green has been the color symbolic of youth and new life. But there are many people to this day who do not realize that the greenness of plants is one of the most important things in the world.



Here the stem of a plant has been cut off near the roots, and a glass tube has been fastened in its place. Notice how the power of "osmosis" has gradually forced sap up into the tube.

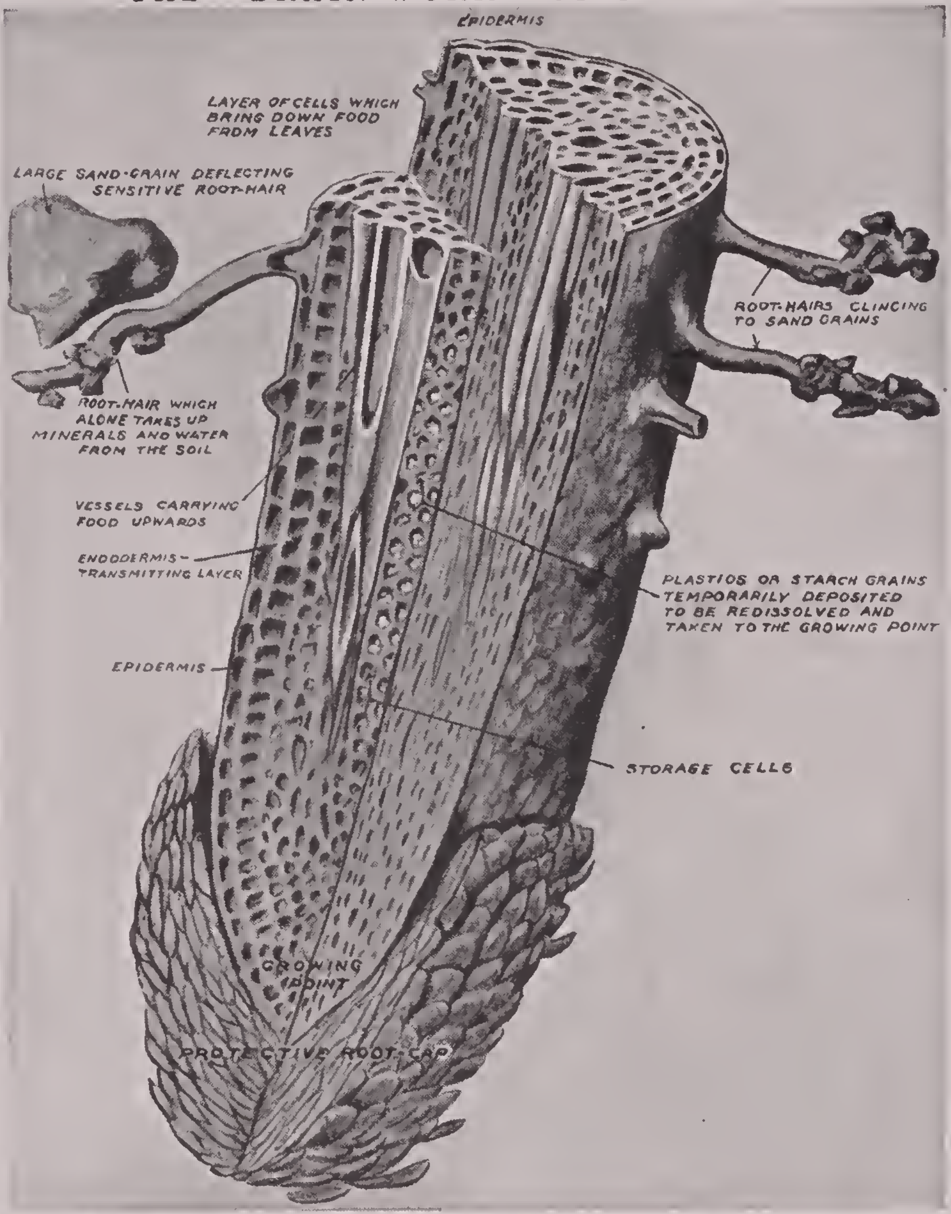
It is the green coloring matter in plants that enables them to take "dead" substances from the air and soil and manufacture living food. In all nature, plants alone can do this. Think what this means! Plants produce the very substances on which all other life depends. Without plants, men and animals could not exist, for they would have no food. What about the meat-eaters you ask? But the answer is obvious: If there were no plant-eating creatures, whose bodies are built up from the substances made by plants, there would be no meat for the meat-eaters to eat. They couldn't live forever on each other. If you trace any food back to its original source, you will find it was made by a plant. Such things as salt, of course, are not true body-building foods.

What about the plants that have no green color, such as mushrooms? They are the "outlaws" of which we spoke earlier. The whole group of fungi, together with a very few of other plant species, lack this green coloring matter, and so are unable to make their own food. They get their food either from the living bodies of animals and other plants, in which case they are called "parasites," or from the decaying remains of animals and plants, in which case they are called "saprophytes." The bacteria of disease, the blights and rusts, the various forms of rot that afflict growing fruit, etc., offer examples of the parasite class; while the mushrooms and toadstools are saprophytes. These two classes of plants are regarded as probably degenerate types which acquired the habit of living on the work of others, and so lost the power of manufacturing their own food.

Outside these two classes all plants contain green coloring matter—even those algae, such as seaweeds, which have other colors so mixed with it that they appear brown or red.

The marvelous green substance which makes plants the greatest factories in the world is called "chlorophyll." It is contained in the cells of leaves and often in the stem and flowers. With its aid, the living tissue of the plant—the protoplasm—is able to absorb the energy from sunlight and use this energy to transform "dead" or inorganic chemicals into "life-giving" or organic chemicals.

THE "BRAIN WORK" OF THE ROOTS


EPIDERMIS
LAYER OF CELLS WHICH BRING DOWN FOOD FROM LEAVES
LARGE SAND-GRAIN DEFLECTING SENSITIVE ROOT-HAIR
ROOT-HAIRS CLINGING TO SAND GRAINS
ROOT-HAIR WHICH ALONE TAKES UP MINERALS AND WATER FROM THE SOIL
VESSELS CARRYING FOOD UPWARDS
ENDODERMIS—TRANSMITTING LAYER
PLASTIDS OR STARCH GRAINS TEMPORARILY DEPOSITED TO BE REDISSOLVED AND TAKEN TO THE GROWING POINT
EPIDERMIS
STORAGE CELLS
GROWING POINT
PROTECTIVE ROOT-CAP

When a root-cap encounters an obstacle, the root bends, not at the tip, but higher, showing that the root-cap has "telegraphed" to parts higher up to push it in a different direction. The picture shows a rootlet much enlarged.

We learn from chemistry that there is one element which is essential to the building of all living tissue, and this element is carbon. Where does the plant get its carbon? From the air, where it exists combined with oxygen in a form called "carbon dioxide." This is a gas, produced whenever organic substances are consumed. Thus when coal or wood are consumed by fire, carbon dioxide is produced; and whenever men or animals consume the food fuel of their bodies, the same thing happens. In the latter case, the carbon dioxide is carried by the blood to the lungs and breathed out into the air, in exchange for oxygen. In both cases the principle is the same—the carbon of the coal or wood, and the carbon of the animal tissue, unites with oxygen and *releases energy;* in the one case it is the energy of the hot flame, in the other it is the bodily energy (also accompanied by heat) which enables us to live and move and do our work.

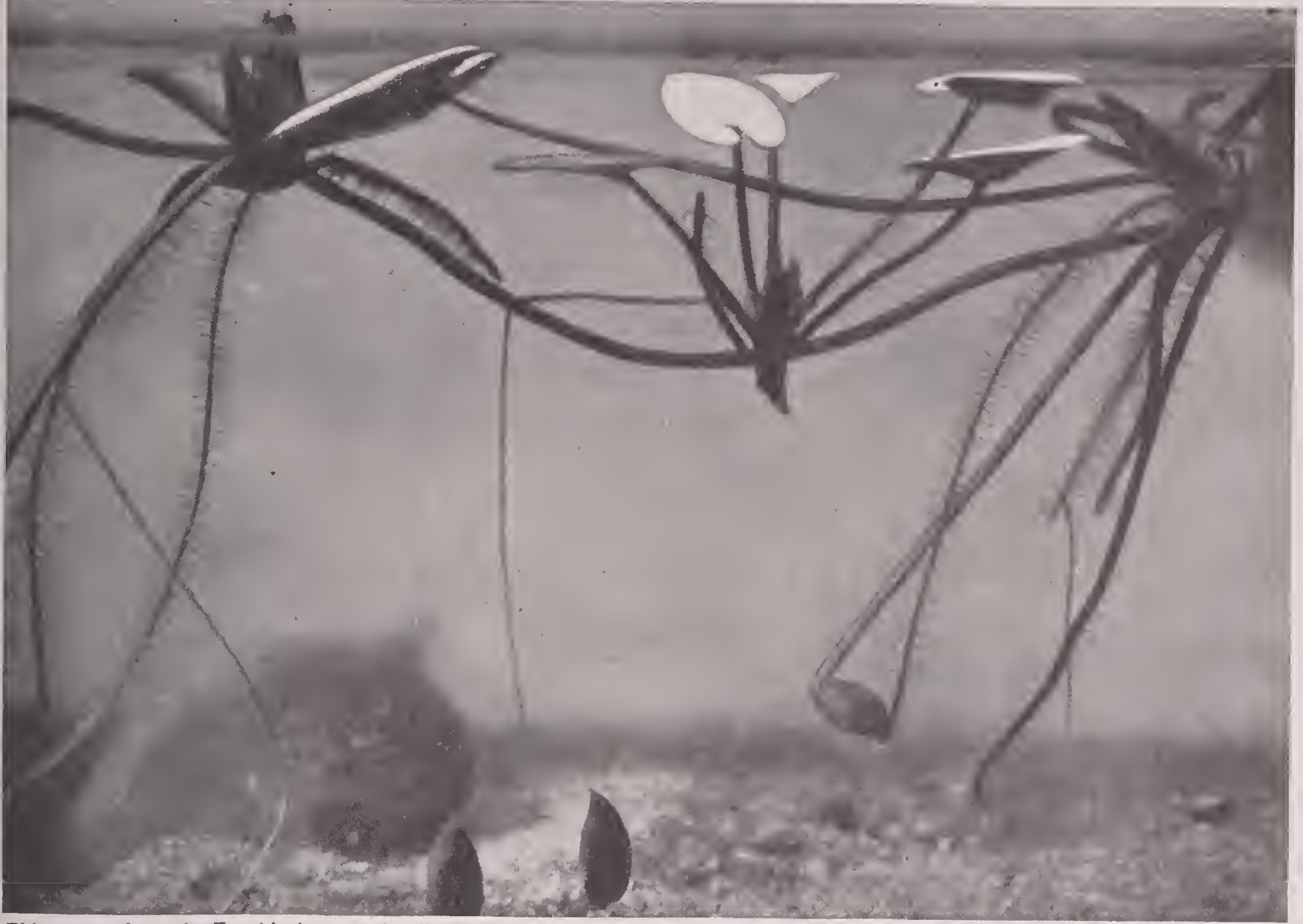
What has this to do with plants? Everything! For this energy which is released must first have been stored up. And it is this work of storing up energy which plants perform. By the aid of the chlorophyll, the energy of sunlight is used to separate the carbon from the oxygen in carbon dioxide and to manufacture certain organic compounds out of which the plant builds its own body. Now, when that plant body or any part of that plant body—leaves, roots, stems, or fruit—is consumed by being eaten or by being burned, the carbon unites with oxygen again and the energy from the sunlight that was used to build the plant body is turned loose again to perform some other work.

Thus the circle is complete. Plants take in carbon dioxide, use the carbon to build their own bodies, and store up energy in the process. The materials of the plant bodies are eaten by men and animals and so built into human and animal tissue. This tissue is then used up in active living, and its energy released—carbon dioxide being again formed in the process.

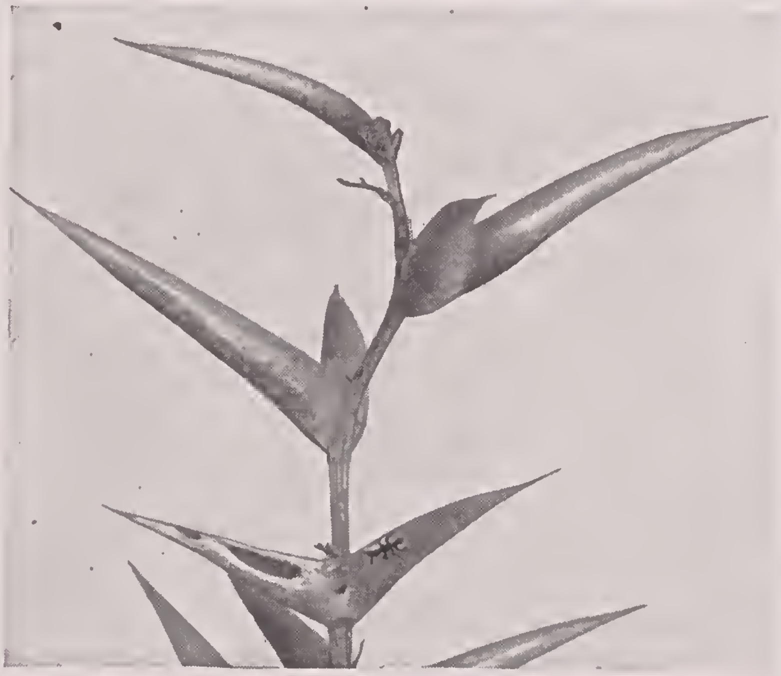
The substances with which the carbon from the air is combined are obtained by the plant from the earth. Water, from which the plant takes hydrogen, is the most important, and with the water there must be certain minerals needed in building various parts of the plant body. These minerals are principally compounds of nitrogen, sulphur, phosphorus, potassium, calcium, magnesium, sodium, and iron.

We must not imagine, however, that plants do not need to breathe just as men and animals do. They need oxygen from the air as well as carbon dioxide; and when they breathe, they also produce carbon dioxide. But during the daylight hours, when they are making their food, they use up all the carbon dioxide that their breathing produces and a great deal more besides, so that a great surplus of oxygen goes out free into the air again. At night, however, when there is no light and therefore the carbon dioxide cannot be broken up in making food, the plant must get its oxygen from the outside air and must also release a certain quantity of carbon dioxide. In all green plants this breathing is carried on principally by the

INGENIOUS TRICKS TO FOIL COLD AND OTHER FOES



This water plant, the Frogbit, is preparing busily for winter. It is stripping itself of all its reserve food, and packing the material into buds on its roots. When full, these buds will drop off and sink into the mud at the bottom, to wait for spring.

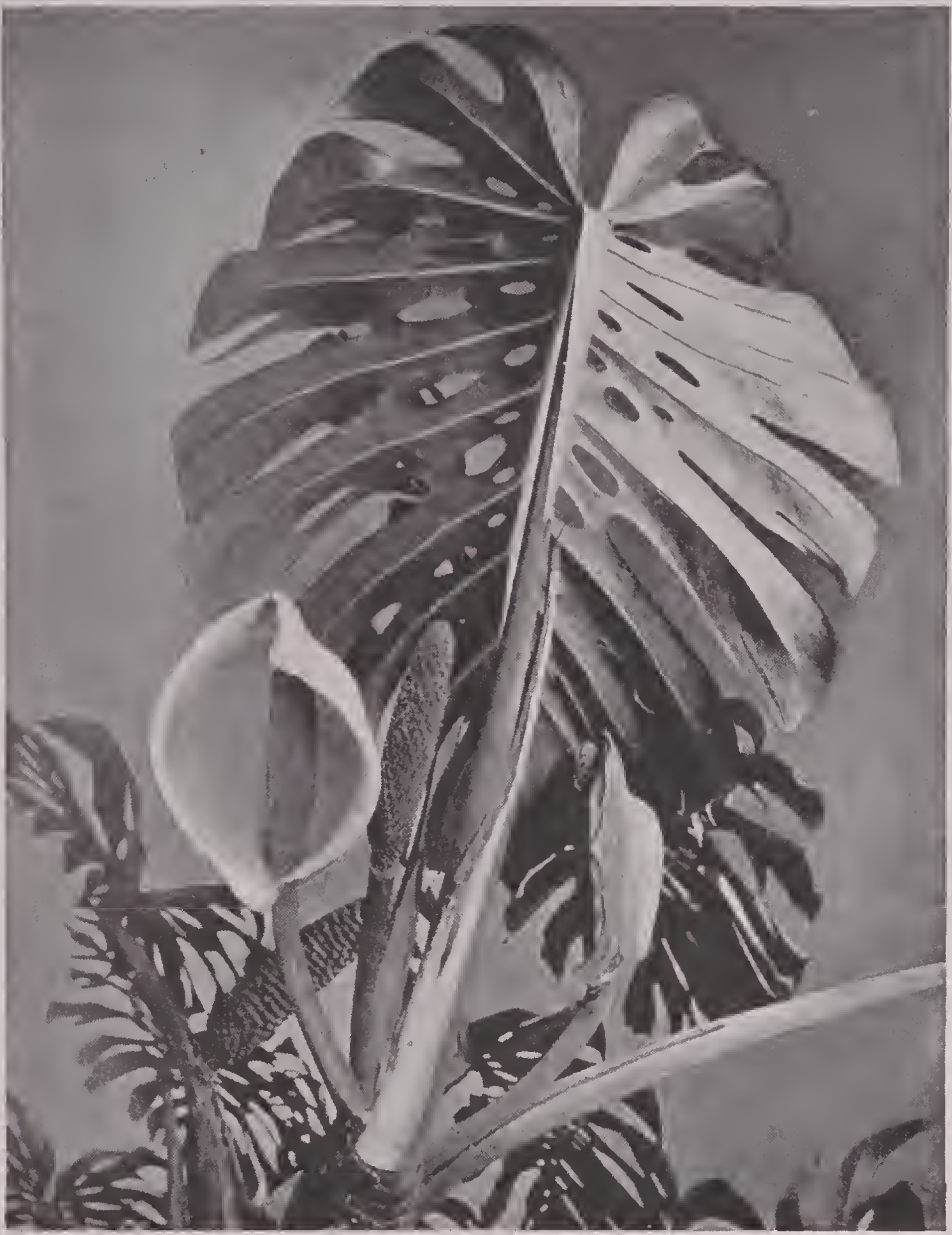


This Acacia of Central America is one of the cleverest of plants. In its hollow thorns it provides a home for certain flesh-eating ants, which serve as the plant's guardians, driving away all leaf-cutting ants which might injure the Acacia.

leaves. Certain saprophyte plants, like the yeasts, which do not live in the air, get the oxygen they need by extracting it from the substances in which they are contained. The changes they cause by taking this oxygen are called *fermentation* (*see* Fermentation; Yeast). The next time, therefore, you eat a piece of bread you will know that the little holes that make it so nice and light were caused by the "breathing" of tiny plants.

The manner in which the higher plants draw water from the soil and carry it through stem and branches to the leaves is one of the most marvelous facts of science. It can easily be illustrated in the following way: Fasten a small sack made of some membrane (say, parchment) over one end of a long glass tube, and pour into the tube a sugar solution, such as molasses. Now plunge this end of the tube into a jar of water and fasten it in place. A surprising result will follow. The water will be drawn from the jar through the parchment, and the liquid mixture will rise in the tube until within two or three days it reaches a height of two feet or more—all without any visible force or disturbance of any kind. The process is called *osmosis*. It is one of the mysteries of physics that it always takes place when two liquids, one of them containing some other substance in solution, are separated from each other by a suitable membrane; the weaker liquid passes through the membrane and mixes with the stronger.

A TRICK OF THE "DELICIOUS MONSTER"



If the big leaves of this South American plant were solid, the upper ones would cut off light from the lower ones. The plant avoids this by having slits and holes in its upper leaves, letting light through.

This is precisely what happens in plants. Among the things manufactured by the plant from carbon is sugar which is dissolved and distributed in the form of sap through each living cell in the entire plant structure. The outer covering of the tiny root hairs consists of a very effective membrane, and so do the walls of the individual cells. You can see, then, how by osmosis the water from the ground is drawn into the roots. Various theories are advanced to account for the rising of water in the plant or tree *after* it has been drawn in by the roots. Osmosis can only account for a part of the process, and one of the best explanations for the remainder of the action is as follows: In the plant there exists connected columns of water from root to leaf. The leaf gives off much of its moisture to the air by transpiration. This probably exerts a "pull" at the top of these columns of water; and the whole columns move up without breaking, owing to the enormous cohesive power of water.

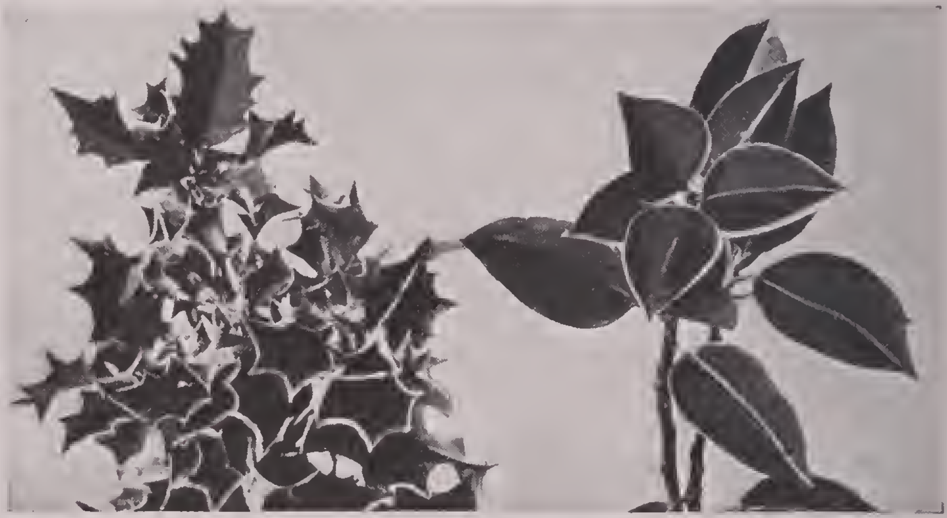
But whatever may be the explanation, it is enough for us to know that a tremendous force is exerted, often developing a pressure in the sap of a tree of many hundreds of pounds per square inch. It is this pressure which helps to hold young stems and flowers rigid and which causes over-ripe plums to burst. It supplies the energy by which buds and flowers can swell and unfold; by which young roots can force a way through hard soil and even destroy masonry and lift curbstones.

To sum up, then, we may say that green plants eat and breathe principally with their leaves and drink with their roots. They need, above all things, air, sunshine, water, and the minerals from the soil which are dissolved in the water. Next to these bare necessities of life, they must protect themselves and reproduce themselves constantly to prevent their race from dying out.

These facts form the A-B-C of the plant language, which must be learned before we can understand the reasons for the many strange things that plants do. In general we may suppose that all of their curious forms and habits are in some way connected with the business of getting these necessities of life, protecting themselves, and of providing for their young. And we may believe that they were all produced during the millions of years of evolution that have passed since the first simple algae appeared on the earth.

The soaring trunks of trees, the clinging tendrils of vines, are simply devices evolved by these plants for

THE "INTELLIGENT" HOLLY



The Holly grows thorny leaves near the ground to protect itself against browsing animals, but on the branches beyond the reach of animals it often produces perfectly smooth leaves. The two twigs here are from the same bush.

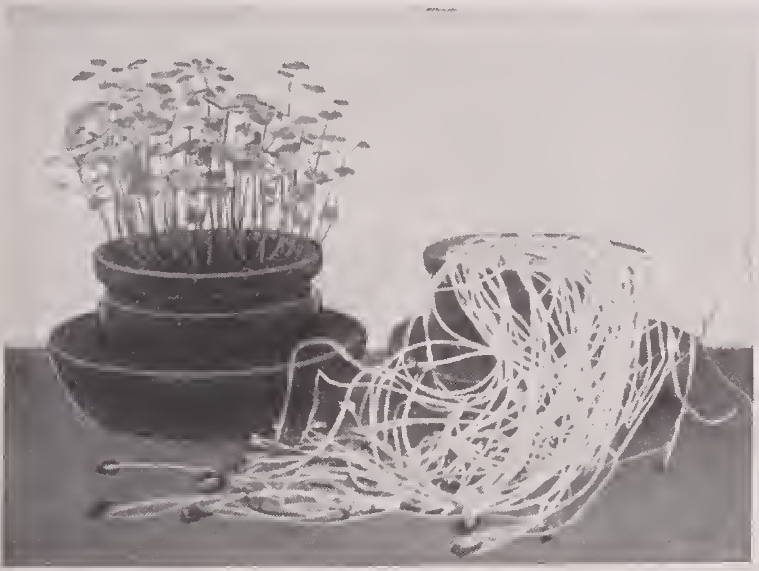
getting up into the free sunshine and air. The great number of branches with their countless leaves, spread out like so many begging hands, show us how the tree tries to get as much sunlight on its "skin" as possible. The tough and waterproof bark was developed to protect the delicate tissue inside against the attacks of insects, as well as to prevent the life-giving sap from running out or drying up (*see* Bark). Thorns are believed to be the result of an effort to drive off browsing animals, which injure the plant. The roots produce sensitive fingers that feel their way through the soil, dodging around rocks, and picking up moisture which is carried up through the trunk and branches, out through delicate veins to the farthest leaf tip, where it is transformed and carried down again to build up the life cells.

Flowers of brilliant hues, delicate odors, and sweet nectar are grown by the plant to attract those insects which carry the pollen that is necessary for the production of fertile seed. And to make sure that this fertile seed will not fall upon crowded ground and have its young life choked out by older plants, provision is often made for carrying it far away from its parent. Perhaps it has tiny hooks that catch in the fur of roving animals; perhaps it has downy wings or leafy "gliders" on which it drifts with the wind; perhaps it is surrounded with a sweet pulp, forming a fruit which birds or beasts will carry to some distant planting ground. (*See* Flowers; Pollination; Seeds and Spores.)

The Struggle of Life in the World of Plants

The efforts of all plants to obtain as much food as possible for themselves, and to provide properly for their young, produces the great struggle we spoke of earlier. For there is not room enough on the earth for all the plants and their seeds, nor is there always enough sunshine and water. They must fight for what they get—not by attacking each other as the animals do—but by pushing and crowding; by sending out the first or the longest roots; by spreading out the highest or the most leaves; by attracting the most insects or sending out the strongest children; by taking advantage of every opportunity that comes their way, "before the other fellow gets a chance."

WITH AND WITHOUT LIGHT



The Buckwheat plants on the left were grown in sunlight. The same kind of seed was planted in the right-hand jar, but the plants were grown in the dark.

WHEN MAN TAKES A HAND

In the circle is a wild rose. Below is one developed by careful selection—a type that Nature could have produced but didn't, because this type of beauty is not particularly useful to the plant.

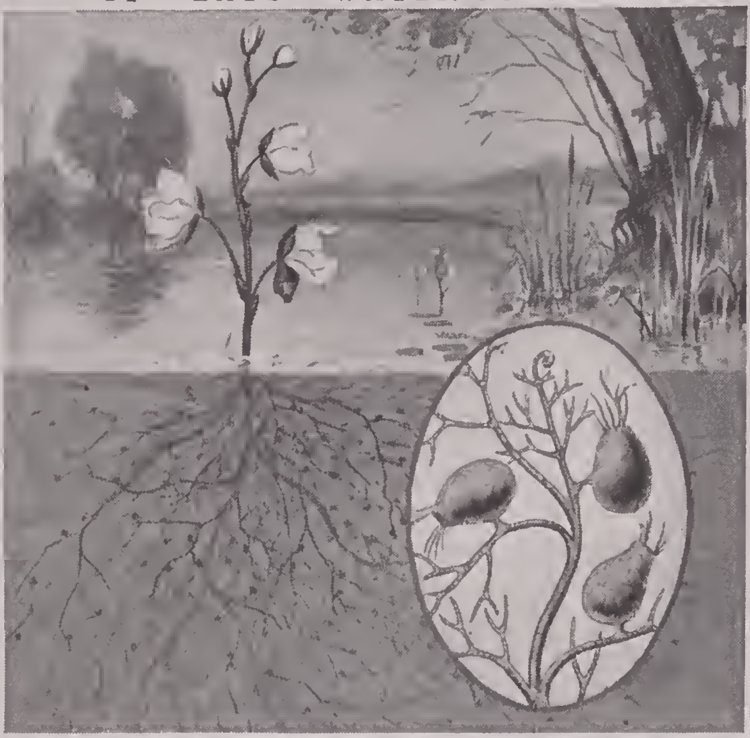
In addition to this struggle for room and for food, plants have to battle against heat and cold, drought and flood. Only plants specially adapted can withstand the low temperatures and the long nights of the Polar regions, or find sufficient nourishment in the thin air of high altitudes, or keep their sap running in the dryness of the desert.

Let us consider some of the strange ways in which plants have managed to survive in this constant struggle, first examining some of the ingenious habits that have been developed by plants as a whole.

If you take an ordinary bean and lay it on damp ground, it will sprout, sending a root into the earth and erecting a stem into the air. If you now turn this sprout upside down, so that its root points upward and its stem downward, you will notice in the course of a day or so that the tip of the root has curved over pointing toward the earth again, and the stem has turned upward away from the earth. This curious instinct of the plant, which makes it sensitive to the force of gravitation, so that it will right itself after being upset, is called *geotropism*, "earth-turning."

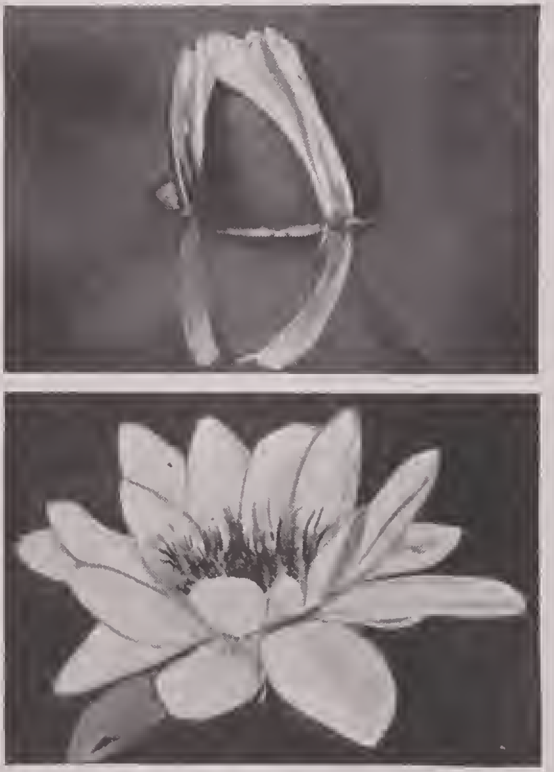
Even more curious, perhaps, is the varied sensitiveness of plants to light, called *phototropism*, or "light-turning," or *heliotropism*, "sun-turning." If a mustard seed be supported on the surface of a jar of water which contains the necessary minerals for its growth, it will sprout and develop just as if it were planted in the soil. If the jar is placed in a room some distance from the window, it will grow in a curious way. The stem will bend directly *toward* the light, the leaves will turn their surface *at right angles* to the light so that their faces catch the most rays possible, and the submerged roots will turn *away* from the light. Certain plants in hot countries escape the danger of getting too much heat from the sun by turning the edges of their leaves in its direction. On the other hand, we know how sunflowers, which need a great deal of light, follow the sun through the day. But perhaps the most remarkable instance of "vision" in plants is the way the leaves on a tree will twist and turn and arrange themselves so as to avoid the shadows of the leaves above them. Even the sizes and shapes of the leaves of different plants are believed to be determined by the amount of light they need. Plants sprouted in the dark remain white, for they have no use for chlorophyll; but they turn green as soon as they are exposed to the light. This peculiarity is made use of in blanching such vegetables as celery and asparagus. The habit in certain plant families—clovers and beans are examples—of drooping their leaves at night, so that it looks as if they had gone to sleep, is an extreme example of phototropism.

IT "EATS" WATER ANIMALS



The root pouches of the Bladderwort (shown larger in the oval) serve a twofold purpose. Shaped like little lobster pots, they entrap small animals which die and help to nourish the plant during its growth. Then, in flowering time, they fill with air and float the flowers above the water, so the insects can reach and fertilize them.

If a plant gets plenty of light, it is also bound to get plenty of air, so that the examples of "air-turning" are not conspicuous. Roots, however, need a certain amount of air in their work, and will readily turn toward that part of the soil which is loose enough to be properly aired, provided also it contains the required minerals. This is a form of *chemotropism* or "chemical turning." A more wonderful example of this, however, is provided by the breeding habits of ferns. When there is sufficient moisture, their egg cells, which lie on the ground, put forth a sort of acid which acts upon the free-swimming male cells, drawing them in by chemical attraction.



At the top, the Water Lily is folded up and drawn partly down into the water for the night. Below, it is open for the day. This is an example of the "light-sensitiveness" (*phototropism*) so common in plants.

Most plants are, of course, exceedingly sensitive to moisture and show *hydrotropism* or "water turning." Drain pipes and sewers are often stopped up by the thirsty roots of poplar trees, which feel their way through crevices in pipes or tiles to get the water they need. Certain plants send down enormously long roots to reach deeply buried moisture, and it seems as if they "knew" beforehand in some mysterious way that the water was there; for at another place which looks exactly the same to us on the surface, but which has no hidden water supply, they refuse to grow at all. On the other hand, trees growing in swamps, where there is danger of having their roots "drowned" by excess of water, will sometimes raise a portion of the roots above the soaked ground so they can get air. This is the case of the cypress of southern United States in the cypress swamps.

Lastly we come to the remarkable sensitiveness of many plants to touch, sometimes called *thigmotropism* or "touch turning." Everyone has seen climbing plants send out into the air long tendrils, which start curling around a wire support as soon as they touch it. That this is due to the plant's sense of feeling can be easily proved by a test. Rub one side of the tendril's tip with a small stick or the point of a pencil and it will start to curl in a very short time, though it will straighten out again if you do not repeat the performance. Certain kinds of ivy will even produce new climbing roots at places where a new contact is felt.

In speaking of the sensitiveness of root tips, Charles Darwin wrote: "We believe there is no structure in plants more wonderful, as far as its functions are concerned, than the tip of the radicle (root). If the tip be lightly pressed or burnt or cut, it transmits an influence to the upper adjoining part, causing it to bend away from the affected side. It is hardly an exaggeration to say that the tip of the radicle thus endowed, and having the power of directing the movements of adjoining parts, acts like the brain of one of the lower animals."

The well-known "sensitive plant" droops promptly at a touch, at the approach of any red-hot object, at a strongly focused light, at the feel of a drop of acid on its leaves, or even at a loud noise, such as the discharge of a firearm.

But the list of habits showing the response of plants to external stimuli is endless. Let us now turn to those methods by which plants guard themselves against special dangers and adapt themselves to unusual conditions. We know that trees constantly exposed to strong winds tend to brace their roots and to strengthen their cellulose skeletons. We also know that evergreens growing in regions of great snowfalls build thicker layers of wood on the under side of their branches, and even alter the arrangement of their branches so that no branch projects far beyond the others—thus making impossible an overload of snow.

Under the influence of extremely dry climates, plants have developed some very ingenious habits concerning water absorption. Some desert plants have produced a stronger sap, which, as we saw in the description of osmosis, enables them to absorb water more powerfully. Others, like the cactus, have developed large cell cavities for storing water. At the same time they have reduced to a minimum their outer surfaces through which water might evaporate, by losing their leaves and all projections not absolutely necessary to getting light and materials for food making. For the plant moisture escapes through the same tiny openings or "stomata" on the green surfaces which admit carbon dioxide to the plant. Some desert plants have solved the difficulty as to water supply by confining their active life to the short rainy season, spending the remainder of the year in a half-dried and resting state.

We have seen that nitrogen is one of the important elements which plants must get. They cannot absorb it in its pure state, but must get it in the form of "nitrates" from the soil (*see* Fertilizers; Nitrogen). Now, wild plants often live in places where nitrates are scarce in the soil. Swamps and bogs are particularly lacking in this respect, for the nitrates dissolve in water and are washed away. To supply this deficiency, certain plants have developed the faculty of *catching and eating insects,* whose bodies are rich in nitrogen compounds. These are known as "carnivorous plants," and their remarkable behavior is described in the articles on Pitcher Plants, Venus's Fly-Trap, and Sundew. There are water plants, such as the bladderwort, which catch small fish for the same reason. They do this by spreading bladder-shaped nets into which the fish enter, and, being unable to escape, they die. The plant then feeds upon their decaying bodies.

Certain forms of bacteria—which are a form of plant life—have the unusual power of forming nitrates out of pure nitrogen taken from the air. The members of the pea family and other "legumes" (as they are called) have formed an alliance with such bacteria; they colonize them upon their roots, thus making sure of a constant and plentiful nitrate

THE INSECT TRAPS

Most plants suffer from the attacks of insects. The Pitcher Plant, however, hits back. Its "pitchers" are traps in which insects are caught and digested.

supply (*see* Bacteria). In return, the legume supplies its tiny cousins with the carbon-made foods, which the bacteria are unable to manufacture for themselves. This is an excellent example of the many forms of natural partnerships in the plant and animal world, which scientists call *symbiosis* ("life together").

How long do plants live? We all know the *annuals*, which flower the same season they are planted, and then, throwing all their strength and reserve food into their seeds, wither and die, root and branch. The *biennials*, showing more care, make only leaves and buds the first season, and store up food in their underground parts, their upper parts dying down in the winter. Examples are the beets, turnips, parsnips, carrots, and many common flowers. The next season the reserve food from the root part is used to make new stems, which bear flowers and seeds; after which the plants perish completely. The majority of wild plants, however, are *perennials* which go on living from year to year. In cold climates they sleep throughout the winter, storing their food in root or stem; in warm climates they simply keep on growing.

THE "MONKEY'S DINNER BELL"

When these seed pods are ripe, they explode with a loud noise, shooting the seeds far and wide. Hence the peculiar name of the South American plant which produces them.

Plants that Never Die a Natural Death

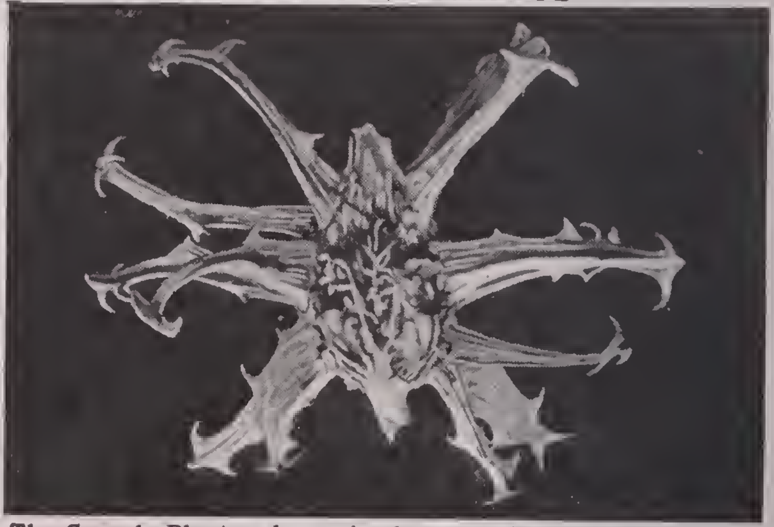
We may say that the very highest plants—and the very lowest—never die a natural death. Such organisms as the bacteria split into two parts, each of which is a new and vigorous life, forming thus an endless chain, which is only broken by some external accident. Trees, on the other hand, keep on growing in the fullness of their vigor until their very size makes the problem of food and water transmission difficult. Perhaps a weakened branch then breaks off under its own weight, the deadly rot-producing fungi enter through the open wound, and soon the giant is brought to the ground. Under favorable conditions, however, trees may live for centuries. Certain of the giant sequoias of California have been estimated by scientists to be 3,000 years old or more.

Most plants in favorable locations manufacture much more food than they themselves use up, storing the surplus in various parts of their structure. This makes it possible for men and animals to live, for it is this surplus food of the plants on which we feed, directly or indirectly. Sometimes this surplus is found in the foliage of bushes and trees, or in the stems and blades of grasses. Sometimes it is stored in the underground parts, such as roots or bulbs (*see* Bulbs, Tubers, and Rootstocks). Again it takes the form of a supply which the plant has laid by for its own children, as in the grain seeds, nuts, beans, peas, etc., where a large amount of concentrated nourishment surrounds the plant germ.

Agriculture began when man selected those particular wild plants which were rich in stored foods, sowed their seeds, and protected the growing plants in his fields and gardens. Removed from the dangers and struggles of their former existence, they have been able to devote more and more energy to the business of making and storing food. Thus our wheat, which was once a wild grass, has developed the rich seeds which give us our flour. The process of evolution is further speeded up when men carefully select their seed for each successive crop so as to produce the qualities they desire. By seed selection we get early maturing corn that ripens in the Dakotas to the Canadian boundary, and wheat that needs but 15 inches of rainfall a year. Finally men have learned that different species of plants can be intermarried or crossed, producing entirely new kinds, with new and desirable qualities. This crossbreeding or "hybridizing" is done by the artificial transfer of pollen between the different species. An American, Luther Burbank, has won a world-wide reputation for new plants "created" in this way (*see* Burbank, Luther; Heredity).

Besides food, plants provide us with many other useful things of life—wood, cotton, and linen cloth, the paper on which our books are printed, etc. Since coal is really a product of ancient plant life, we may thank the vegetable kingdom for the coal tar dyes with which our fabrics are stained, and for many of the chemicals that are used in medicine and industry. Plants also supply us with countless drugs and oils and perfumes, with the fiber out of which so many new synthetic materials have been made (*see* Cellu-

READY FOR TRAVEL



The Grapple Plant makes animals spread its seeds. The seeds are armed with hooks, which cling to passing animals.

lose), with materials for soap-making, and indeed with substances which enter into almost every industrial process.

How Plants are Classified

The following is a useful classification of the members of the Plant Kingdom:

Group I. Thallophytes, including algae, fungi, bacteria, lichens.

Group II. Bryophytes, including liverworts and mosses.

Group III. Pteridophytes, including ferns, horsetails, and club mosses.

Group IV. Spermatophytes, or seed-producing plants.

(1) Gymnosperms, such as pines, spruces, hemlocks, cedars.

(2) Angiosperms, the true flowering plants. These were the latest plants to be developed in the history of the earth, and they have the most complicated structures. They are divided into:

(*a*) Monocotyledons, such as the cattails, pond-weeds, grasses, sedges, palms, lilies, orchids, etc.

(*b*) Dicotyledons, including many herbs and shrubs, and such trees as the poplar, oak, hickory, elm, willow, etc.

PLATA RIVER. The Plata River, or Rio de la Plata, as this great estuary on the east side of South America is also called, receives waters of one of the mightiest river systems of the world, for the two rivers by whose junction it is formed—the Paraná (about 1,600 miles long) and the Uruguay (about 1,000 miles)—drain with their tributaries an area of nearly 1,200,000 square miles. The Plata forms the commercial inlet and outlet for a vast territory, comprising the greater part of Argentina, Uruguay, and Paraguay, and parts of Bolivia and Brazil.

At times of flood-water the mighty Plata discharges a volume of 2,000,000 feet a second, twice the flood maximum of the Mississippi; and the muddy current is discernible 100 miles out into the ocean. The estuary extends about 170 miles northwest from the Atlantic, varying in width from 138 miles at the mouth to 25 miles at the head. To the two great cities which lie on its banks—Buenos Aires, capital of Argentina, and Montevideo, capital of Uruguay—it brings the commerce of the world. Constant dredging is necessary to keep it navigable for ocean vessels, however, because of the silt deposited from the muddy streams. Its intricate and changing channel is only 36 feet deep at Montevideo and half that depth at Buenos Aires.

PLATINUM. Imagine a cube of silvery grayish-white platinum a foot each way. Not a very great mass of metal, you might think. But try to pick it up, and you would quickly find your mistake, for platinum is one of the heaviest metals—nearly twice as heavy as lead—and this one-foot cube would weigh more than half a ton, while a similar cube of coal would weigh only about 40 pounds.

If you possessed such a mass of platinum you could call yourself a millionaire, for it would constitute an appreciable fraction of the world's supply and at the price prevailing at the close of the World War it would be worth something more than $2,000,000. But when platinum was first discovered, nearly two centuries ago, it was so cheap that ingots of it were gilded and sold as "gold bricks" by swindlers, and later the Russian government used it for small coins as we do nickel. Its amazing leap in price since 1890, when it was worth $16 a troy ounce, to the price of $105 an ounce fixed by the United States government during the World War, is due to its scarcity and the peculiar qualities that make it indispensable in chemical and electrical apparatus. For these reasons the government found it necessary to "commandeer" the unmanufactured stock during the war, to discourage its use in jewelry, and to request everyone who had platinum articles which were not needed to sell them for use.

One of the "Noble" Metals

One of the most useful properties of platinum is its chemical inertness. It is one of the so-called "noble" metals, resisting the attack of any of the common acids singly, though it dissolves in a mixture of nitric and hydrochloric acids. It is the only metal that successfully resists the attack of the acids of saliva and hence it is extensively used in the manufacture of false teeth. The chemist, too, finds it indispensable for crucibles and other articles of laboratory equipment, both because of its resistance to acids and because of its high melting point, which ranges from 3,092° to 3,272° Fahrenheit.

Platinum expands less under heat than any other metal. Hence it is used in devices for measuring temperatures too high for ordinary thermometers (*see* Pyrometer). Another characteristic of the greatest importance is that under rising temperatures it expands at nearly the same rate as glass. Until recently it was the only otherwise suitable substance with this property, and so it was extensively used in electric light bulbs. Platinum wires were fused into the glass to make the connection between the wires carrying the current and the filaments within. A less expensive substitute has now been found, however—an alloy called *platinite*, made of iron and nickel.

Thinner Than a Spider's Thread

Another interesting property of platinum is its extreme ductility. A single ounce of the metal could be drawn out into a wire so fine that it would reach from New York to New Orleans. Such a wire would be smaller than a spider's thread.

In its finely divided forms, such as platinum sponge, platinum black, and platinized asbestos, it is one of the most useful of the "catalysts." A catalyst, one whimsical writer says, is a chemical "parson"—it brings about chemical unions and reactions without being itself affected by any permanent change. For instance, at ordinary temperatures hydrogen and oxygen are indifferent to each other. But hold a bit of spongy platinum in a stream of escaping hydrogen, and the hydrogen will unite with the oxygen of the air; that is, it will take fire. So, too, in the contact process for making sulphuric acid, platinized asbestos is used as a catalyzing agent.

The alloy of platinum with iridium, another metal of the platinum family, is one of the most resistant substances known, so far as the wear of time and use are concerned. On this account it is used for making national standards of weight and measure and also for the writing tips of fountain pens.

Platinum is used also in making platinotype photographs and in jewelry. Its name, a diminutive of the Spanish "plata," silver, was given because of its resemblance to that metal. It occurs usually in small grains or flat scales, sometimes in nuggets, generally associated with gold and with one or more of five other rare metals, namely, iridium, osmium, palladium, rhodium, and ruthenium. The world's present supply has been estimated at about 5,000,000 ounces, 95 per cent of which came from the Ural Mountains in Russia, 4 per cent from Colombia, where platinum was first discovered, and the remaining 1 per cent from Ontario, Australia, Borneo, Alaska, Oregon, California, Brazil, and elsewhere.

PLATO (*plā'tō*) (427–347 B.C.). Of all the sages and philosophers of antiquity, Plato is the best known and the most widely quoted. Succeeding generations have clothed his name in a cloud of intellectual romance, and his many writings have been made the basis for an endless number of moral, religious, and political doctrines.

Born of aristocratic parents, Plato received the customary Athenian education in poetry, music, oratory, and gymnastics, and at about the age of 19 became a pupil and friend of that delightful teacher, the great Socrates. Plato remained with Socrates until the latter was put to death by the Athenians, in 399, assisting and defending the master at his trial (*see* Socrates). This association had the profoundest influence on the young man, and shaped all his later thoughts and his writings.

The next ten years Plato spent in travel, visiting Egypt and other countries on the Mediterranean. In Sicily he incurred the enmity of Dionysius, tyrant of Syracuse, who caused him to be sold as a slave. He was ransomed by one of his friends and returned to Athens, where he set up a school in the famous Academy, a pleasure ground about a mile outside the city. There beneath the lofty trees, Plato taught philosophy to the youth of Greece, until his death at the age of 80; and thus the word "academy" received the associations it has ever since borne. Plato's fame spread over all the civilized world, and brought him many pupils who later became famous. Chief among these was Aristotle, who was destined to surpass even his master in certain departments of philosophy (*see* Aristotle).

Plato left behind him a great number of works, mostly in the form of dialogues, in which Socrates appears as the leading character. It is chiefly through the mouth of his old teacher that Plato sets forth his doctrines, which are presented in the Socratic method of reasoning by question and answer. Written often in a high, almost poetic, vein, they are nevertheless examples of severe and subtle thinking. Benjamin Jowett (1817–1893), the distinguished English scholar whose translations of Plato have taken a high place in English literature, said that "the germs of all ideas, even of most Christian ones, are to be found in Plato." The best known of Plato's works are the 'Republic,' in which he outlines the ideal government, the 'Symposium', in which a group of banquet guests discuss ideal Love and Beauty, the 'Timaeus', which deals with the nature of the physical universe, and the 'Apology', which is not in dialogue form, presenting a vivid portrayal and defense of Socrates.

The PLACE *of* PLAY *in the* WORK *of* LIFE

What Physical Recreation Does for Mind and Body—Some Attractive Games for Children of All Ages and How to Play Them.

PLAY AND GAMES. Play is part of the serious business of the child, for it is an essential part of his growth. The long process of his development includes on its physical side much that belongs to the lower animals. He is a whole menagerie. He runs like a hound, climbs like a monkey, digs like a woodchuck, dives like an otter, swims like a fish, fights like a bulldog, and in it all works like a beaver and is busy as a bee.

The child becomes what he is as a result of what he does. Nature decrees certain activities and builds the body around them. And of the activities that build the child, an important part are those directed from the mind; so the child is largely built by his conscious action, and the name given to this conscious part of his action is *play*.

No child can resist play and be a well-rounded social being. Play is necessary if a child shall live. It is instinctive, having been handed down through unnumbered ages. Fortunately for our citizenship, the play instinct has taken a new lease on life with the establishment of community playgrounds and recreation centers, under the supervision of trained workers who teach what games to play and how to play them. At the same time they correlate the activities which bridge the gap between the play period of the child and the economic life of the adult. The boy in the city has no other place for wholesome play. He has nothing but the street for a playground, and nothing in the street provided for his play. Give him a chance at "the game"; provide for him an opportunity to perform difficult feats on a horizontal bar or the flying rings, or from a diving board, and the juvenile court will be deserted for the public playground.

The Duke of Wellington said that Waterloo was won on the playgrounds of England's great public schools. Athens and Rome had their intellectual

POPULAR GAMES FOR LITTLE BOYS AND GIRLS

These children are playing "Follow the Leader." The little girl in the foreground is walking across the bench, in her turn, while in the left background the children at the end of the line are swinging the maypole. An ingenious leader will think of many other funny "stunts" for this game.

The boy in the center of the circle is "Puss." If any of the other children step inside the circle he may tag them, and then they must help him tag the others. The fun begins when the players tease Puss by stepping in and out of the ring. Of course the first child caught is "it" for the next game.

supremacy because they built a perfect body for men and women, knowing that a healthy mind would follow. No brain can work properly without the nourishment of strong blood. No virile thoughts can emanate from a brain fed by organs neglected through life. A well-fed body, a body with muscles and organs well trained, will furnish a mind with strength, purity, and nobility. It is a child's right to have ambition to be a leader, and we do not accord him his privilege if we withhold the opportunity to build a body that will make his brain active, powerful. and creative.

The following games are of value in bringing out that desirable leadership in the child, and in developing a normal sense of fair play, mental alertness, and physical strength.

Games for Younger Children

Cat and Rat.—This game is for 10 to 30 or more players. One player is chosen for the cat and another for the rat. The other players form a circle by clasping hands. The cat is on the outside of the circle and the rat inside. The game opens with a conversation between the cat and the rat.

The cat says, "I am the cat." The rat says, "I am the rat." The cat says, "I will catch you!" The rat says, "You can't!"

This remark of defiance starts the chase. The cat tries to get into the circle after the rat, but the rat evades him by running in and out of the circle. The rat is assisted by the players, who raise their hands to let him through; but the cat is prevented by the players, who try to keep him on the opposite side of the circle.

When the rat is caught, he joins the circle. The cat becomes the rat and a new cat is chosen.

Do This, Do That.—For 10 to 60 players, or more. All of the players stand facing one of their number who is the leader. The leader assumes a gymnastic position or performs some act and at the same time says, "Do this!" The others imitate him. If the leader says "Do that!" instead of "Do this!" and the players imitate the action, they must pay a forfeit. If a mistake of this kind occurs three times the player is out of the game.

The positions and actions should be such as are familiar to the players—chargings, head bendings, trunk bendings, arm movements, knee bendings, hopping, jumping, dancing steps, etc., or familiar actions such as hammering, sawing, washing, ironing, sewing, shoveling, riding horseback, etc.

Drop the Handkerchief.—For 10 to 30 players, indoors or out of doors. All of the players but one stand in a circle. The odd player runs around the circle carrying a handkerchief which he drops behind one of the players in the circle. He must try, if possible, not to let any of the circle players know where he is dropping the handkerchief. He may resort to various devices for misleading the others by quickening his pace or slacking up as he desires.

DROP THE HANDKERCHIEF IS AN OLD FAVORITE

The boy on the outside is carrying a handkerchief which he is about to drop behind one of the children in the ring. The child behind whom he drops it must pick up the handkerchief and run around the circle after the first boy. It will be hard to catch him, because, no matter how watchful the players are, he will be sure to have a little head start.

As soon as a player discovers that the handkerchief has been dropped behind him, he must pick it up, leave his place vacant, and chase the one who dropped it. If he catches this leader before the latter reaches the vacant place, the leader is a "rotten egg," and must sit in the center of the circle for the rest of the game, then the player who caught him drops the handkerchief. If the leader, on the other hand, drops the handkerchief behind a player, and gets around the circle back to that player before the latter picks up the handkerchief, the latter is a "rotten egg."

Follow the Leader.—For 5 to 60 players. One player, who is especially resourceful or skilful, is chosen as a leader. The others all form in a single file behind him, and imitate anything that he does. The leader aims to keep the line moving and should set particularly hard tasks for them—such as climbing or vaulting over obstacles and under others, jumping certain distances, taking a hop, skip and jump, walking backward, turning around while walking, walking or running with a book on the head, etc. Anyone failing to perform the required feat drops out of the game or goes to the foot of the line. At the pleasure of the players he may pay a forfeit for the failure and continue playing. All forfeits are to be redeemed at the close of the game.

Puss in the Circle.—For 10 to 30 people. A circle is drawn on the floor. One player is Puss in the center and the other players stand around the outside of the circle. If these players come inside the circle they may be tagged by Puss. They will make opportunity for this by stepping in and out of the circle, teasing Puss in every possible way to tag them. After being touched by Puss, a player becomes a prisoner and must help Puss inside of the circle to tag the others. The last one to be tagged wins.

Games for Older Children

Three Deep.—This game is simply our old-fashioned Tag elaborated. The players grouped in couples (one player behind another), form a large circle, facing in. One player is selected as a runner, and another is "it," or the chaser. The chaser attempts to tag or touch the runner, who endeavors to escape by dodging in and out the circle. If the runner is not immediately caught, but is in imminent danger, he may save himself by standing in front of any couple, making "three deep." This crowds off the rear player of the original couple. He immediately becomes the runner and is chased until caught, or until he saves himself by standing in front of another couple, making it "three deep," and crowding off another player. When the chaser catches a runner, the former becomes a runner.

As a game this renews the interest in Tag, because of its many superior points. It is a game that gives every player a chance, instead of being a game for the few fleet of foot. The uncertainty and the many rapid changes keep every player alert.

Puss in a Corner.—All of the players but one stand in corners or convenient goals. The odd player goes from one to another saying, "Pussy wants a corner." The player addressed answers, "Go to my next door neighbor." In the meanwhile the other players watch their opportunity to exchange places while Puss is attracted in some other direction. It is up to Puss to get into one of these places when vacant.

The sport of the game consists very largely in tantalizing Puss by making many exchanges, or, on the other hand, in Puss suddenly dashing for some

THE EXCITING GAME OF "THREE DEEP"

This is one of the best games for a large group of children, because it keeps every child on the alert. The runner should not try to run for a long time, but should make "three deep" soon. The oftener this is done the more children will get actively into the game, and every child will be kept on the watch.

"PUSS" IS HAVING A HARD TIME TO FIND A CORNER

When the number of children is large, it is hard for Puss to catch one of them. Then he may call "all change," when he can usually slip into somebody's place in the general confusion.

vacant place without giving previous evidence of knowing of it. When Puss secures a corner, the odd player becomes Puss. If Puss does not succeed in getting a corner as desired, he may call, "All change!" and all the players must change corners. Puss then can usually slip into a place.

Spin the Platter.—All players but one are numbered and seated in a circle. The odd one stands in the center and twirls a platter, tray, or some other round object. As he starts to spin the platter he calls a number, and the player bearing that number must spring up and catch the platter before it stops spinning and falls to the floor. If successful he returns to his place; if not, he takes the place of the spinner and pays a forfeit. The forfeits are redeemed at the end of the game.

Instead of numbers names may be given the players.

I Spy.—One player is chosen for the spy and blinds his eyes, while the others scatter and hide. The spy counts one hundred, and then sings out—

One, two, three!
Look out for me,
For I am coming and I can see!

Or he may just say "Coming!" or merely the last count, and then leave the goal. The spy tries to detect as many players as possible, and for each player must dash back to the goal, hit it three times with his hand, and call out, "One, two, three for—," naming the player. Should he make a mistake in identity, the player really seen and the one named by the spy are free. As soon as a player knows he has been detected by the spy, he should race with the latter for the goal or "home" and, if he reaches it first, should hit it three times and call "One, two, three for me!" Any player can make the goal whether he has been detected or not, and may save himself in this way. Should all save themselves in this way, the same person must play spy again; this seldom happens, however. The first one caught by the spy—that is, the first one for whom he touches the goal—becomes spy for the next game.

Frog in the Middle.—One player is chosen for the frog and sits in the center on the floor with his feet crossed in tailor fashion. Where there are more than 20, it is well to have two frogs. The other players stand in a circle around the frog, repeating, "Frog in the sea, can't catch me!" They dance forward toward the frog, tantalizing him and taking risks of being tagged. If the frog touches one of the players, he exchanges places with him. The point is that the frog must not at any time leave his sitting position until released by tagging another player.

Potato Spoon Race.—This is a form of potato race that may afford much amusement, especially for indoor companies. The players are divided into two or more groups which compete against each other. Each group lines up in single file, so that the leaders all toe a starting line. Placed on the floor in front of each group, and stretching ahead in the same direction, should be a row of potatoes at intervals of two or three feet apart, one for each player in the file. The larger and more irregular in shape the potatoes are, the better. There should be from six to ten potatoes in a row. Each leader has a teaspoon and beside him is a pan, box, or basket in which the potatoes are thrown. At a given signal each leader starts forward, takes up a potato on the spoon, carries it to the basket or box and places the potato in it. He then hands the spoon to the next player, and passes off the playing field, not lining up again with his team. The second player picks up the next potato, puts it in the basket, and so on until all have played. The last one stands beside the box with the spoon held aloft as a signal that he has finished.

No player may touch the potato with anything but the spoon. Should a potato be touched otherwise, the player must replace it and pick it up again on the spoon. Should a potato drop off the spoon it should be placed on again and the game continued from this point.

The game may also be played in the following manner: Ten potatoes, or peanuts, or blocks of wood are placed five feet apart in rows from the starting line. At the signal "Go!" the racers (one runner for each row of potatoes) run from the starting line and pick up the potatoes one at a time, returning to place them in a box or basket back of the starting line. The player getting all of his potatoes into his box first, wins.

Going to Jerusalem.—For 10 to 60 or more players, in parlor, gymnasium, or schoolroom.

A row of chairs is placed in the center of the room, so that they face alternately in opposite directions—one chair to one side, the next to the opposite side, etc. There should be one less chair than the number of players. The game is much more interesting when played with a musical accompaniment.

The game begins with all of the players except one seated in the row of chairs. The odd person is the leader, and his first object is to recruit the players for his trip to "Jerusalem." He carries a cane and walks around the row repeating, "I'm going to Jerusalem! I'm going to Jerusalem!" in singsong. Every few minutes he stops at his discretion and knocks with his cane at the back of the chair of some player. Immediately the player thus summoned rises from his chair and follows the leader, sometimes having a lively time to encircle the row of chairs and catch up with the leader. The next player knocked for follows the first one, and so on, until all are moving around in single file. The leader may reverse the direction at his discretion. This general hurry and confusion for the start may, with a resourceful leader, add much sport to the game.

When the players are all recruited, they continue to march around the row of chairs, the main object of the game being the scramble for seats when the music stops, or upon some other signal to sit, if there is no music.

The musician will add to the interest of the game by varying the time of the march from slow and stately to "double quick." At any moment, after all the players are marching, the music may stop suddenly. Whenever this happens the players all scramble for seats. There will be one odd player left without a seat. This player is thenceforth out of the game and retires to one end of the room, taking with him one of the chairs. This continues until there is only one chair and two players left. The one who secures this chair wins.

Where two players reach a chair at nearly the same time, the chair belongs to the one who first reached it, or who is sitting more fully upon it. Sitting on the arm of a chair does not count, nor touching it with the hands or knees.

When played in a gymnasium, a row of gymnasium stools may be used instead of chairs, and the gathering up of the players omitted, the game starting with the stools empty.

When played in the schoolroom, the game starts with all of the players ready to march, the first part of the game, in which they are recruited, being omitted. The class should march in serpentine form up one side and down the next aisle, etc., instead of encircling the seats. There should be for a large class from one to six seats less than the number of players. For instance, one seat should be counted out in each row or each alternate row. The seat that is not in play may be designated by turning it up, if of that variety, or by placing a book on the desk belonging to it. The same may be done in place of removing a chair after each stop.

Wherever played, the game may be carried on without music, simply by the leader or teacher beating time and stopping when players are to sit; or he may give a signal or a command to "Sit!"

Indoor Games for Rainy Days

The Minister's Cat.—For any number of players in parlor or schoolroom.

The first player says, "The minister's cat is an avaricious cat," using an adjective which begins with "a" to describe the cat. The next player makes a remark about the cat, using the same initial letter for the adjective; for instance, that it is an "aggressive" cat. The letter "a" is used until the game has gone entirely around the circle, or until no player can think of another word beginning with "a." The first player then makes a similar remark about the cat, using an adjective beginning with the letter "b," and so on through the alphabet. Any player who is slow to respond, or who fails, must either drop out of the game or pay a forfeit, as may be decided at the start.

Blowing the Feather.—All the children except one sit on the floor around a sheet or table cloth, which they hold about 18 or 20 inches above the floor. A feather

SIMON SAYS "STOOP"

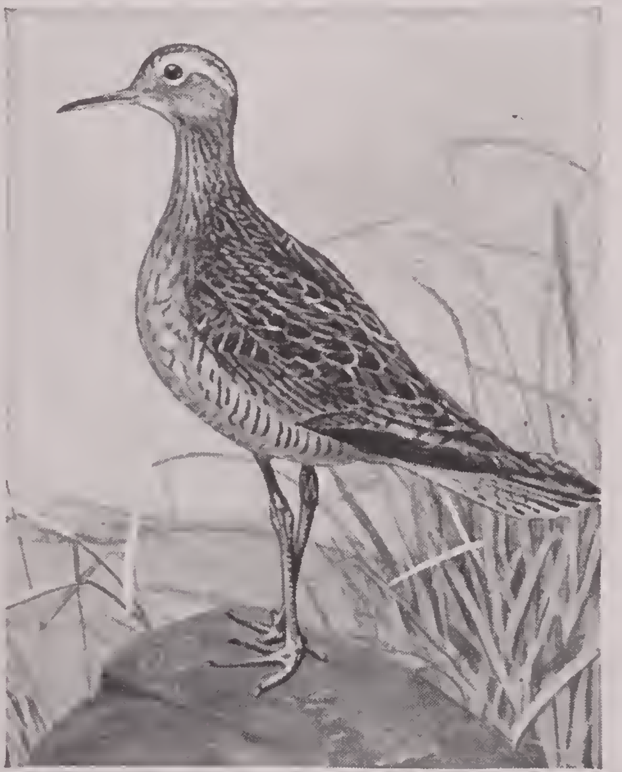
"Simon Says" is a little like "Follow the Leader," because the leader tells everybody what to do, but it is different because the children do not move about. They remain in their places in the circle.

is placed on the sheet, and at a signal the child nearest it blows the feather toward another child. The object is to keep the feather in the air, not allowing it to alight.

The remaining child runs back and forth around the group trying to catch the feather. When he is successful, the person on whom the feather rested, or who was nearest to it, changes places with him.

Simon Says.—Seat yourselves in a circle and choose one of the company to be the leader, or Simon. His duty is to order all sorts of different things to be done, the funnier the better. His orders, however, are to be obeyed only when the order begins with "Simon says." For instance, when he says, "Simon says: 'Thumbs up!'" all must obey; but "Thumbs down!" should not be obeyed, because the order did not commence with "Simon says!"

PLOVER OR "RAIN BIRD"



According to an old French legend the Plover got his name because he was easier to catch in rainy weather than at any other time (the word comes from *pluvia*, the Latin for "rain").

Each time this rule is forgotten a forfeit must be paid. "Hands over eyes," "Stamp the right foot," "Pull the left ear," etc., are the kind of orders to be given.

Hissing and Clapping.—As many chairs as there are players are arranged down the middle of the room. The girls all sit down so that each has a vacant chair next her, and the boys retire from the room. During their absence the girls decide which particular boy is to occupy the vacant chair next each girl, and the boys are summoned in turn. On entering the room the boy must walk straight to the chair next the girl whom he imagines to have chosen him, and sit down. If he has guessed correctly he is loudly clapped by all the girls present, and another boy is called in. But if he makes a mistake, and sits down on the wrong chair he is hissed so vehemently that he is only too glad to escape from the room. Another player is called in, and the process is repeated, until finally all the boys have guessed correctly, and all the vacant chairs are occupied.

PLEIADES (*plē'yȧ-dēz*). The group of fixed stars known as the Pleiades were once, according to Greek mythology, the seven daughters of the Titan Atlas. According to some accounts they committed suicide from grief at the fate of Atlas, their father, who was compelled to bear the weight of the heavens on his shoulders. According to others they were companions of Artemis (Diana), and, when pursued by the hunter Orion, were rescued from him by the gods, and set aloft in the sky. Only six of the stars are usually visible. The seventh, called "the lost Pleiad," was said to hide herself for shame because she had married a mortal. The group of the Pleiades, which is now reckoned to contain about 400 stars, forms part of the constellation Taurus.

PLOVER (*plŭv'ẽr*). Among the most interesting of the "vanishing shore-birds" of North America—those birds which have their home along rivers, on ocean beaches, and marshes—are the plovers. They are shorter and plumper than most of the shore-birds, and as their short pigeon-bill is not adapted for finding food in deep mud or soft sand, they are often found feeding in the upland regions. The plover family includes about 75 species and they breed in all parts of the world.

The largest of the family is the black-bellied plover, a very shy and wary bird, about 12 inches long, with plumage of buff mottled with brown. In summer it wears an apron-like front of black plumage. It breeds on the Arctic coast and winters in Africa and southward in America from California through Brazil and Peru.

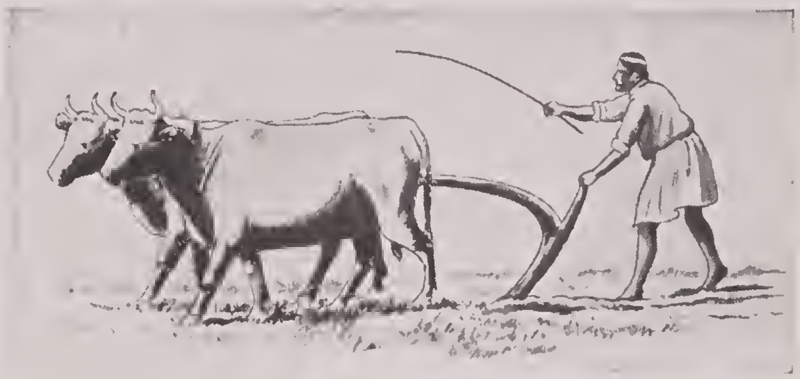
The golden plover, a slightly smaller species with conspicuous spots of yellow, is of special interest because of its wonderful migrations. Breeding along the Arctic coast, these birds, about August, migrate southward in great flocks. From Labrador, they pass down the coast to Nova Scotia; there, leaving land, they fly straight to the West Indies, then cross the Gulf of Mexico, and appear on the coast of Brazil; from there they proceed by land to the pampas of Argentina. Returning north to breed, they pass through the interior of the United States, up the Mississippi valley to the Arctic region.

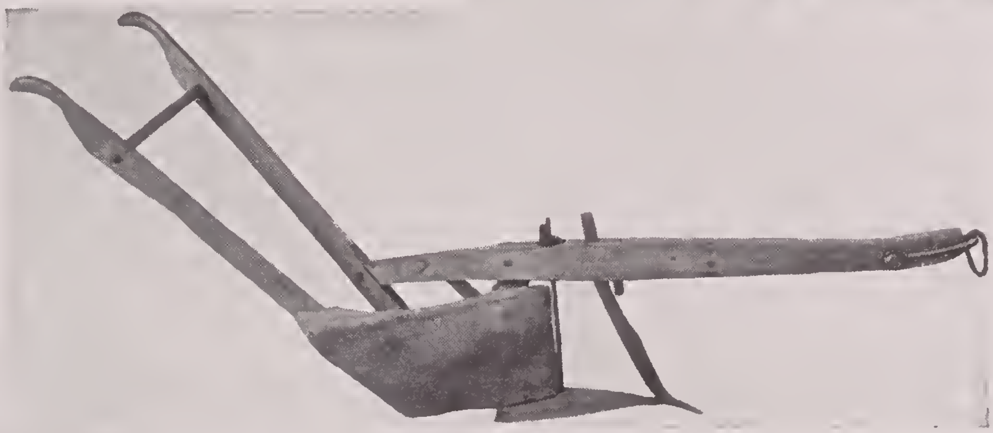
The killdeer (or "killdee") gets its name from its loud strident cry, "*kill-dee, kill-dee!*" It is a true plover and an important shore-bird, but is often found miles inland, frequenting freshly plowed fields, where it eats grubs and worms. It also feeds largely on mosquitoes and the dreaded fever-tick of the South. As it does no harm, its feeding habits alone should serve to protect it, especially as its flesh is not very palatable. The killdeer is about ten inches long, olive-brown above and pure white below. It breeds in the northern parts of the United States and in Canada, and winters south, through the Gulf States and South America. It is usually found in colonies. (For illustration in colors, *see* Birds.)

The order of shore-birds includes also the avocets and stilts, comparatively large birds, with exceedingly long necks, long slender bills, and long legs; and the snipe and sandpiper family (*see* Snipe and Sandpipers). So-called "upland plovers" are Sandpipers. Scientific name of black-bellied plover, *Charadrius squatarola;* of golden plover, *Charadrius dominicus;* of killdeer, *Aegialitis vociferus.*

PLOW. When the plow developed from the crooked stick and crude wooden affair of primitive days to the modern well-planned steel tool, more land could be plowed and larger and better crops raised; for proper preparation of the soil for planting and right cultivation are basic conditions of good agriculture. Until after the close of the American Revolution only the point or "share" of the plow was of wrought iron or steel. Then came several patents for improved cast iron plows; and in 1855 James Oliver of South Bend, Ind., revolutionized plow-making with his invention of a process for making the chilled iron plow.

THE DEVELOPMENT OF THE PLOW





First a forked branch or tree, one end of which was used as a ploughshare; then a wooden plow, with a wooden mold-board to turn the soil; finally the largest multiple or gang plow ever built, drawn by gasoline tractors.

Modern plows of many different kinds are now made. There is the walking plow, which the plowman still holds in position by gripping the curved handles as he walks in the furrow behind it. The sulky plow is a plow on wheels, with the plowman riding and shifting levers to guide the work. The gang plow has two or more plows fastened together in one frame so as to turn a number of furrows at once; large gangs of three to eight plows require a tractor or steam engine. The sod plow for breaking new land simply cuts and breaks up the sod, and there is also the subsoil plow for deep plowing. Plows are adapted to these various purposes by the shape of the plow bottom and the angle at which it is set on the frame. The parts of the plow bottom are the moldboard, which turns the furrow; the colter, which cuts the surface in advance of the moldboard; the sharp-pointed share, which is directed into the ground and cuts the bottom of the furrow; and the landside or flat side, that presses against the land to aid in guiding the plow. The disk plow utilizes rotating steel disks instead of a plowshare to cut the soil.

PLUM. Wild and cultivated, coming from America, Asia, and Europe, ranging in size from a cherry to an egg, colored purple or dark blue, red, yellow, and green, plums are a common and productive fruit. The United States is well supplied with hardy varieties, adapted to all kinds of soil and practically every section of the country. When this continent was first settled by white men, many varieties of plums were found growing in different regions. These have been improved by cultivation and flourish in the orchards of their native regions. Among them are the comparatively useless beach plum of the Atlantic coast; the Canada, the Chickasaw, and the wild red, each in its section; and the wild goose, also a red plum, popular in the Central States, and so called because the parent tree grew from a seed taken from the crop of a wild goose.

In addition to the native varieties, cultivated plums from Europe have been introduced and flourish especially in the New England States and on the Pacific coast. Among these are the English damson, a small oval purple plum, and the small high-flavored green gages, as well as a number of egg plums. Many fine varieties of Japanese plums are adapted to growth in the Pacific coast region. This region is the leader in plum-growing, and the center of the important prune industry of this country; for the prune is a plum (all plums belong to the genus *Prunus*) and the most important food variety. (*See* Prunes.)

The Bartlett plum is a "sport" variety developed by Burbank which has the flavor of a Bartlett pear. Plums have also been developed under cultivation with small stones and without any stones at all. Plums are grown from seed only for the sake of new varieties; old varieties are perpetuated by budding and grafting.

PLUMBING. When you turn the water on or off in the kitchen sink or in the bathroom, you bring into play the water pipes; and when you pull up the stopper or otherwise allow the dirty water to drain out, you bring into play the drain pipes. These two systems of pipes form the essentials of a building's plumbing. The water pipes lead back from the faucets through floors and walls and out of the building to larger pipes or conduits under the streets, called water mains; and the drain pipes connect with underground conduits called sewers.

Modern plumbing fixtures are remarkable both for cleanliness and beauty. Painted iron or steel pipes, or the more expensive brass, copper, or nickel-plated pipes, convey hot and cold water into our shining porcelain or white enameled sinks, bowls, and tubs (*see* Enameling). Such fixtures are far more sanitary than the old-fashioned wood-inclosed plumbing—the grease-absorbing cast-iron sink, and the marble washbowl and sheathed-in bathtub, which gathered dirt and waste around their edges, joints, and corners.

The poisonous gases forming from the drainage matter in the sewers must be prevented from getting into the building through the drain pipes. This is accomplished generally by the "trap," a U-shaped or an S-shaped crook or elbow, with a clean-out on its under side. Water always stands in the bottom of the trap, so the gases cannot get beyond it. Traps should be equipped with vents or other devices to prevent this water from being exhausted by the forming of a vacuum in the waste pipe (*see* Siphon). Overflow outlets in bathtubs and other fixtures should never be connected to the sewer side of the trap (*see* Sewerage; Waterworks). Plumbing gets its name from the Latin word *plumbum*, meaning "lead," because pipes of this flexible metal have been found best adapted to such use.

PLU'TARCH (about 46–120 A.D.). Probably no historian of ancient times has been more widely read or has had a greater influence than this keen-witted historical essayist and biographer. Plutarch's 'Lives' has been called "the food of great souls" because of the wealth of wisdom it contains, and it formed the inexhaustible storehouse of fascinating stories from which Shakespeare drew the plots of several of his plays.

Plutarch was not a critical historian. He was interested primarily in character, and so he blended fact and legend into a tangle which only modern scholarship has been able to separate. But despite this defect, his biographies remain one of the foremost sources of information about classical antiquity. Young and old for centuries have delighted in reading them for their enthralling incidents and their masterly sketches of character, but the reader must remember that they are not all authentic history.

The 'Parallel Lives of Illustrious Greeks and Romans' are written in pairs, and they contrast the careers and qualities of such men as Demosthenes and Cicero, Alexander and Caesar, Pericles and Fabius. Besides these, Plutarch wrote about 60 ethical essays, known as the 'Opera Moralia', discussing such subjects as "The Education of Children," "How to Get Benefits out of Enemies," "Advice to the Married."

Plutarch was born at Chaeronea in Boeotia, a district of Greece; he was educated in philosophy at Athens, and spent several years at Rome, where he lectured on philosophy and enjoyed the friendship of men of learning. His last days were spent in his native city, where he was a magistrate and priest. He was much sought after for his delightful and learned conversation, and a school gathered about him to listen to his lectures.

PLUTO. In Greek and Roman mythology Pluto was the god of the lower world. He was first called Hades ("the unseen"), and was represented as pitiless and fear-inspiring. Later his character underwent a change and he became a beneficent god, bestowing blessings produced in the depths of the earth. His name then was changed to Pluto ("giver of wealth"). When Zeus, Poseidon, and Hades cast lots for the kingdoms of heaven, the sea, and the infernal regions, the last fell to Hades. Here he ruled with his wife Proserpine over the dead and over the other powers below (*see* Hades).

PLYMOUTH, ENGLAND. From the decks of an ocean liner at anchor in the harbor of Plymouth, the westernmost of England's south-coast seaports, one sees at once why England has been likened to a great garden. Patches of darker green woods alternate with the paler shades of growing crops, with not the least blemish of untidiness to be seen—no fences, no tumbledown shacks, no glaring red barns, no advertisements—the whole landscape looking as if it had been gone over with a fine-toothed comb.

The town of Plymouth, within these encircling rounded knolls, is situated on the west bank of the River Plym, and it is of peculiar interest to all Americans. From Plymouth Sir Francis Drake set out on his voyage around the world. Near the citadel, which was begun by Henry VIII, at the head of Plymouth Sound, stands a striking statue in memory of Drake who was once, too, mayor of the little town. Plymouth supplied seven of the ships which struggled against the Spanish Armada; and it was in the sound that the English fleet awaited the coming of the Spaniards.

On the northeast side of the citadel is the Mayflower "commemoration stone," which records the fact that this was the last port touched by the Pilgrim Fathers on their way to America. Plymouth today is an important port and naval station, and many trans-Atlantic liners put in there to discharge passengers and freight for London. Population, about 210,000.

"A BAND *of* EXILES *on the Wild New England Shore*"

PLYMOUTH, MASS. When the *Mayflower* dropped her anchor in the harbor of Plymouth, in December 1620, and the weary storm-tossed Pilgrims stepped upon that shore (*see* 'Mayflower'), they rejoiced that their long hard voyage was over. But the worst of their trials and hardships was yet to come, and more than half of the little band died during that first year of indescribable sufferings.

Their place of settlement had previously been explored by Captain John Smith and had, strangely enough, been named Plymouth after the very port in England from which the Pilgrims had embarked. So here it was that the historic landing of the Pilgrims was first made, on Dec. 11, 1620 (or December 21, according to the new style of reckoning—*see* Calendar). It was not until a week later that the rest of the party, including the women and children, set foot on shore.

The cruel New England winter was already upon them, and the whole country, as one of their number wrote, "was full of woods and thickets, and presented a wild and savage hue." At once they set about felling trees and building log huts for shelter. They had no horses or oxen to haul the logs, and but a few axes and other simple tools. The labor was exhausting and they suffered intensely from exposure and the constant wetting in coming and going from the ship. After the *Mayflower* departed, food was scanty and consisted mostly of fish. A dreadful pestilence came upon them and wrought such havoc that at one time there were only about six or seven well persons to care for the others. Among these was Miles Standish, who proved himself a tender nurse as well as a fearless soldier. The women suffered most, and of 16 mothers but four remained alive at the close of that terrible winter. Of 25 fathers, only 12 were left. Governor Carver was among those who passed away, but under the wise leadership of William Bradford, the second governor, the colony survived.

THE FOUNDATION STONE OF NEW ENGLAND

According to legend, the Pilgrims stepped upon this bowlder from their ship *Mayflower*, when they landed in the harbor of Plymouth. The rock is now protected by an elaborate canopy erected in 1920 to celebrate the 300th anniversary of the Pilgrims' landing.

Lest the Indians should learn how greatly their numbers were reduced, the bodies of those who died were buried at night, and in the spring corn was planted over the graves. Fortunately the settlers were able to win the friendship of some of the Indian leaders. Tisquantum, or Squanto, an Indian who had been captured by the crew of an English vessel to be sold as a slave in Spain, but who had escaped to England and there learned the English language, became their interpreter. Through him and Samoset, an Indian chief, a meeting was arranged with the powerful Massasoit, sachem of the Wampanoags, and a treaty of peace was signed. This was never broken on either side so long as any of the signers lived. Massasoit proved himself a true friend to the Pilgrims, and sent them news of a threatened attack by other Indian tribes. One day an Indian brave came bearing the skin of a rattlesnake filled with arrows, as a challenge to war from the chief of the Narragansetts. Governor Bradford returned the skin filled with bullets, and the Indians abandoned the attack.

The friendly Indians also taught them how to plant Indian corn, and next year's harvest banished famine and want from the settlement. In ten years the result of the brave venture of this little band of freedom-seekers in the New World had proved not only a great moral victory, but an economic success as well. They had paid all their debts and proved that it was possible for a small body of earnest men and women to maintain themselves independently in the New World. Thus they paved the way for further colonization, and laid the foundation of the new nation.

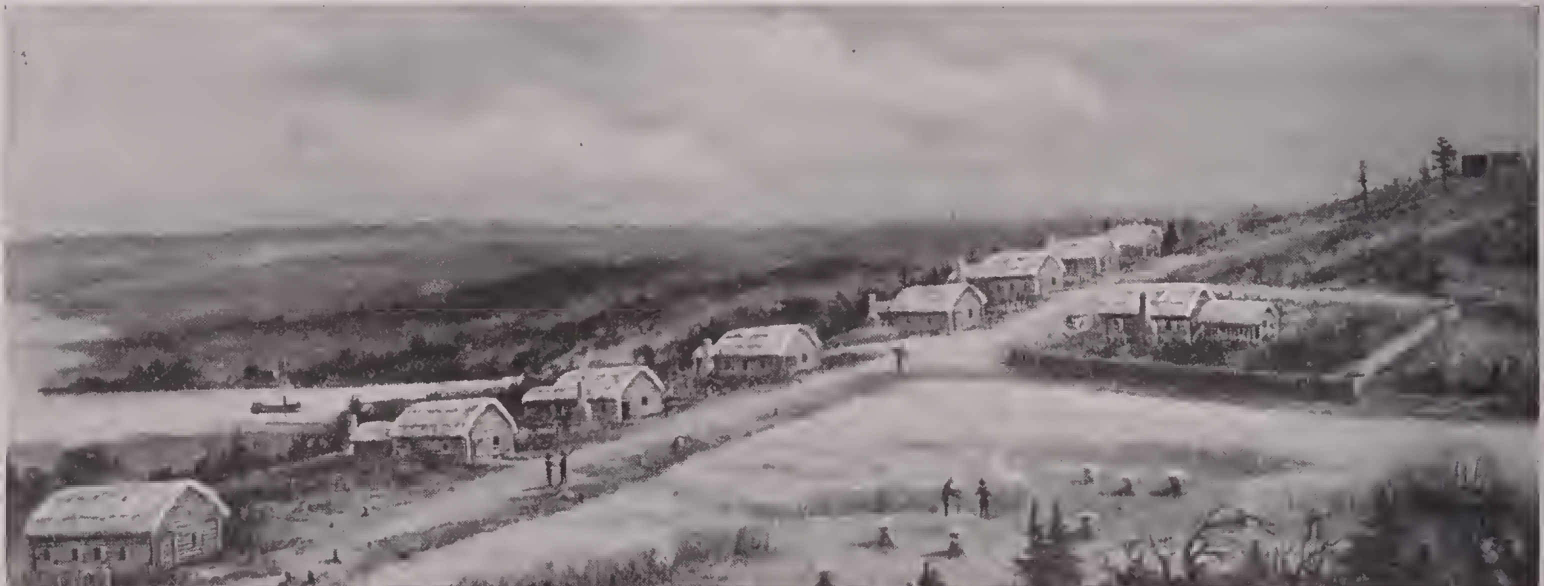
THE HOME OF CAPTAIN MILES STANDISH

Longfellow, in his poem 'The Courtship of Miles Standish', has given immortality to the military leader of the Pilgrims. This is the house Standish is said to have built for himself at Duxbury, the town which he helped to found in 1626 after Priscilla Mullens (according to Longfellow) had decided that she preferred John Alden as her husband.

If the Pilgrims could return today to the city of Plymouth, they would not recognize it as the place where they landed. They would find a thriving town of more than 13,000 people. They would see the largest factories of rope and twine in the world, as well as factories for making woolens and rubber goods, and they would be told that one-fourth of the cranberries grown in the United States are harvested near Plymouth. They would find the tidal harbor greatly improved, and would see steamships and other craft at the docks laden with hemp, coal, and other supplies, and in the summer landing excursionists from Boston. Outside the two protecting barriers of Plymouth Beach and the Gurnet headland, they would see in the distance a stream of vessels on the way to and from the Cape Cod Canal (*see* Canals).

Leyden Street, so named by the Pilgrims after the Dutch city which had given them refuge, still runs up from the waterside, parallel with the Town Brook, but it is very different from the days when it was the center of the little settlement. Here on either side were staked out the homesteads of the first 19 families, and here the logs were dragged to build their rude houses. Plymouth Rock, "the corner stone of the nation," on which the Pilgrims are said to have stepped as they came ashore, is carefully sheltered by a granite canopy. In Pilgrim Hall, erected by the Pilgrim Society in 1824, are to be seen a portrait of Edward Winslow, the patent or charter of settlement granted by the Council of New England in 1621, Captain Miles Standish's sword, and Governor Bradford's Bible. In the fireproof building of the Registry of Deeds are carefully preserved the records of Plymouth Colony until it was united with Massachusetts Bay Colony in 1692, and the original of the charter granted Jan. 23, 1630. In the north part of the city stands the national monument to the Pilgrim Fathers, dedicated in 1889.

PLYMOUTH, TWO YEARS AFTER THE PILGRIMS LANDED



The first houses were all built on a single street, which the Pilgrims named Leyden, after the Dutch city which had given them refuge. The house at the extreme left was built first. There the colonists stored their food, and there everybody ate and slept while the other houses were being built. The house surrounded by a stockade was the home of Governor Bradford. All the buildings were of rough hewn timber, with thatched roofs and windows of oiled paper. At the top of the hill, on the extreme right, is the first meeting house, which was also used as a fort.

THE PILGRIMS FIND BASKETS OF CORN

In the middle of their first winter, with food scarce in the little settlement and no prospect of help from England until spring, the men explored the neighborhood, and in some heaps of sand found baskets of corn, which the Indians had stored in this way for their winter needs. Corn was an unknown grain to the colonists, but they found it much to their liking, and in the spring some friendly Indians gave them more corn for seed, and showed them how to plant it.

contained in the Easy Reference Fact-Index at the end of this work

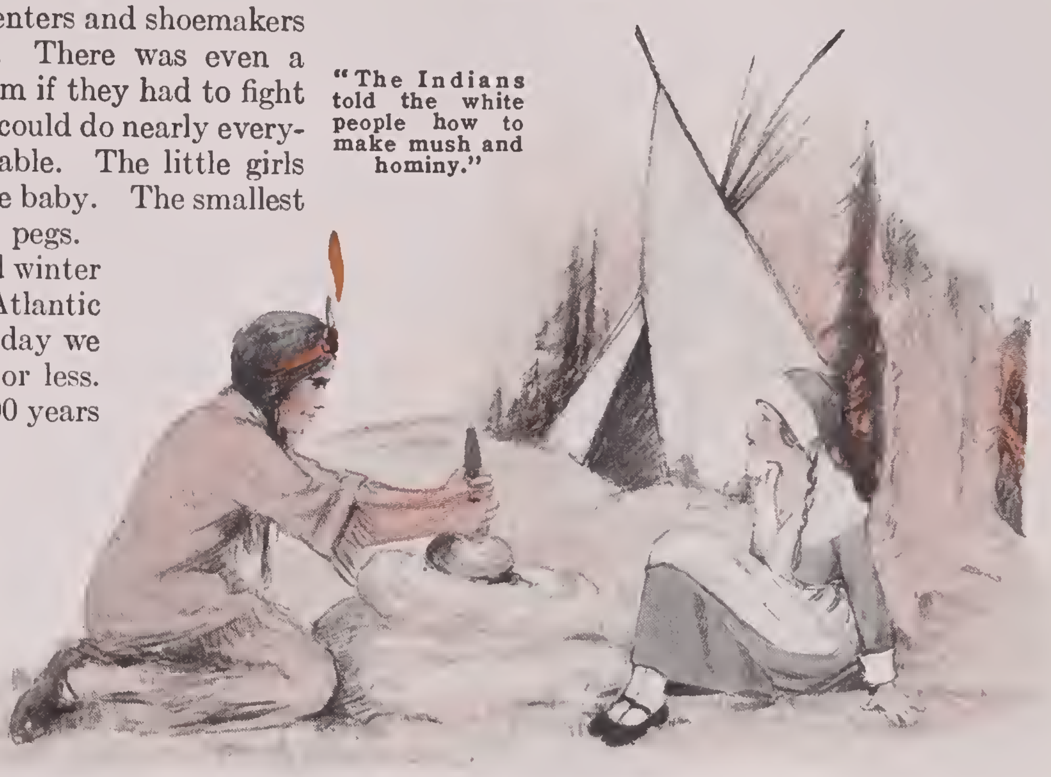
Children of the Pilgrims

SIX-YEAR-OLD Faithful was knitting a stocking. Her home was a pretty stone cottage with a thick roof of straw, in a village in England. Roses grew around the open door, through which she could see the square gray tower of a stone church covered with ivy. The bell in the tower rang sweet chimes. The church had pointed windows of many-colored glass. The fences between the cottages were thick green hedges. A mill stood beside a dancing river and the mill-wheel churned the water to foam. Little Faithful's English home was as pretty as a fairy story, but her father often talked of going away to the New World of America to live. They were safe and comfortable in England, but they were not happy. They dressed and lived more soberly than their neighbors. They did not like to go to the king's stone church, but wished to hold meetings of their own kind, where the sermons were preached by plain lay preachers instead of by surpliced clergymen. For this they were punished, for it was against the law to attend any services except those of the Church of England. Unkind people mocked them, and called them Puritans, but they were proud of that name because they were trying to "purify" their religion and bring it back to the simplicity of the early days.

Faithful wore a long plain gown of dark wool. A square of white lawn was folded around her neck. On her head was a stiff white linen cap almost like a sunbonnet. Her face was rosy and dimpled; her loving eyes as blue as violets. Her yellow hair just *would* curl, and that was a trouble, for a little Puritan girl had to keep her hair smooth. She wore a white apron, with a pocket to hold her thimble and thread. The Puritans thought it wicked for even a little girl to be idle. Her brother Myles wore a wide-brimmed pointed hat, knee breeches, and a tightly buttoned coat. He wore a wide, square-cornered white linen collar. Both of these children had big brass or silver buckles on their stout low shoes.

One day their father said they must get ready to go to America. Other Puritan families, who had for some years lived in exile in Holland, were going with them in a sailing vessel. They had to take ever so many things with them, for they could not buy even a needle in the wilds of America. They packed big chests with clothing and blankets and feather beds and table linen. Cooking pots and pewter dishes and candle sticks were put into barrels and boxes. The mother did not forget the spinning wheel and loom for weaving. The father thought of tools and seeds and guns and knives and fish nets, and he put in a box of books, also.

One hundred "Pilgrims" stood on the deck of the *Mayflower* and said goodby to the green shores of England. Every one of the company could do something useful. There were carpenters and shoemakers and blacksmiths and farmers. There was even a soldier among them to lead them if they had to fight the Indians. Puritan mothers could do nearly everything to make people comfortable. The little girls could knit and sew and mind the baby. The smallest boy could whittle wooden shoe pegs.


"The Indians told the white people how to make mush and hominy."

It was a long journey, in cold winter weather, over the sea. The Atlantic ocean is 3,000 miles wide. Today we cross in steamships in a week or less. But the Pilgrims came over 300 years ago in a little sailing vessel, and the voyage took more than two months. Great waves beat the sides of the ship and rolled almost over it. The snow fell thick and ice covered the deck. Fogs shut them in, so they could not see where they were going. Icebergs as big as hills floated in the water, and they saw whales. By and by they saw sea gulls. They were near land.

The land to which they came was not green and pleasant like England. All they saw was black rocks and bare forests, and soon fields of snow were everywhere. Of course there were no houses for them to live in, so first of all the men had to chop down trees in the forest and build warm log houses, with chimneys of clay and sticks. Doors of ax-hewn boards were hung on wooden hinges. Thick oiled paper covered the small openings left for windows, but there was plenty of light from the big log fire. The straightest logs were split and laid for floors. The carpenters made tables and stools and bedsteads. The blacksmith swung long iron bars in the chimney to hang cooking pots over the fire. Everything was carried from the ship into the houses. Then the *Mayflower* sailed away home. The little palefaces were alone in the wide, wide New World of America with the red children of the forest.

"Mother did not forget the spinning wheel."

Home Life and the Good Indian Neighbors

They had a great deal to show to each other. The Indians brought corn and told the white people how to make mush and hominy, and how to grow corn in that rocky soil by placing in each hill a fish as fertilizer. They brought maple sugar and in the early spring taught their white neighbors to make maple syrup. In the summer Faithful and her brother found wild grapes, plums, and crab-apples, strawberries, blackberries, and blueberries. In the fall there were nuts of many kinds. They gathered wax bayberries to make sweet-smelling candles. The carpenters made boats to fish for big cod, and the children dug clams from the sand on the beach.

How cozy it was in the log home in the evening! Half a tree could be put in the fireplace. The children ate their supper of hominy and syrup and deer meat from bowls of wood. But they had white linen cloths and napkins. They brought their manners and their prayers and their school books to America. A woman taught them to read and write and spell and do sums in one of the cabins. They learned their letters from a "horn book," more like a slate than a book. Their only reader was the Bible, and Faithful read the Bible through three times before she was 12 years old. Besides all this, she helped her mother. In America she had to learn to sweep a room clean with an Indian broom of birch twigs and to brush the hearth with a turkey wing. She made strong, brown soft soap by boiling lye water, dripped through wood ashes, and fat together.

Her brother went into the woods with his father to cut down trees. The forest land had to be cleared for fields, to grow corn and wheat and flax. Around every cabin was a little garden to grow peas and cabbages and flowers. Oh, how the children watched the first green sprouts come up. And how they clapped their hands when they saw the first English daisy or pink rose. The flowers made America seem more like a real home. In the fields and woods were violets and buttercups, as in England. One tiny, sweet-smelling flower in the pine woods that pushed its pink waxy clusters and glossy leaves right through the snow was strange to them. This we call the trailing arbutus, but they called it the "mayflower." Once in many months a sailing vessel came and brought them things from England. When it sailed away it took the furs of bears and beavers and foxes to sell in London.

As the years passed, other Puritans settled in New England, some at Salem, others at Boston, and others elsewhere. Sometimes the Puritans and the Indians had fierce battles. The red man wanted the forests for hunting, and the white man wanted the land for farms and towns. Every settlement of white people had one big cabin that was both a meeting house and a fort. The men carried their guns and powderhorns to church with them. They carried them also when they went to the fields to plow. Sometimes they built high walls of pointed stakes around their villages. After many years the Indians went deeper into the woods and left the country near the sea to the white people. The Puritans learned to love their home in New England, where they could worship according to their own consciences, and rarely did any of them think of going back to Old England.

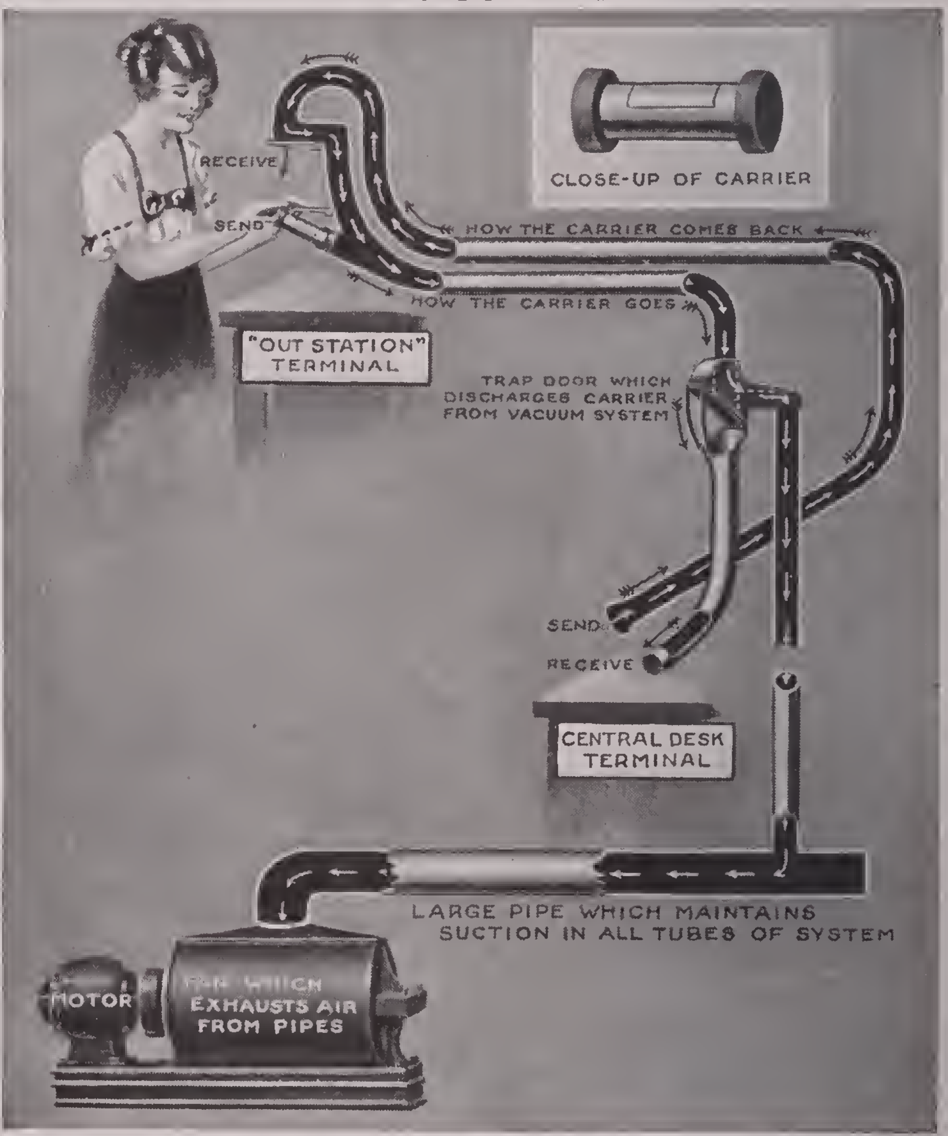
Other English people who were different from the Puritans came to America. But Faithful and Myles never saw the English children who lived in big houses by the wide rivers of Virginia. America was so big that the towns were hundreds of miles apart. Little Dutch children came to America to live, too, and French children and Spanish children, but they all lived so far from each other that they could not pay visits. The little drab-gowned, soft-spoken Quaker children who lived near the town of Philadelphia did not come until a long while after the time of Myles and Faithful.

PNEUMATIC APPLIANCES. "As light as air" is a saying which expresses the everyday opinion about the substance we breathe. But when this seemingly "weightless" substance is compressed, it exerts tremendous power. So also if it be exhausted from an enclosed space, the inrush of other air to fill the vacuum is powerful (*see* Vacuum). These two sorts of power have been applied to a great variety of useful tasks.

One of them can be seen in most large department stores. If you take a long brass tube and connect an air pump so that the air is continually being exhausted from it, the air will rush in violently when either end is opened. Suppose now you open one end and slip in a small brass cylinder, with felt around its ends to make it fit the tube. The pressure of air trying to get in the tube from behind will shoot the cylinder along the tube, and by placing the other end at any desired point, you can make the arrangement deliver the cylinder anywhere you want. A trap door at the other end will let the cylinder shoot out, and snap shut quickly enough to keep air from rushing in to fill the vacuum.

Compressed air may be used to drive the carrier cylinder along, instead of a vacuum to draw it. Both systems are largely used also to transmit messages about banks, "copy" from department to department of newspaper offices, and even under city streets

HOW A PNEUMATIC TUBE SYSTEM WORKS


RECEIVE
SEND
CLOSE-UP OF CARRIER
HOW THE CARRIER COMES BACK
HOW THE CARRIER GOES
"OUT STATION" TERMINAL
TRAP DOOR WHICH DISCHARGES CARRIER FROM VACUUM SYSTEM
SEND
RECEIVE
CENTRAL DESK TERMINAL
LARGE PIPE WHICH MAINTAINS SUCTION IN ALL TUBES OF SYSTEM
MOTOR
FAN WHICH EXHAUSTS AIR FROM PIPES

This picture shows how the carriers travel back and forth in the tubes of a big store. When the carrier is inserted at any point in the system, it speeds forward until it strikes a trap door, which opens outward. The door snaps open long enough to let out the carrier, but not long enough to let in much air. A suction fan is constantly exhausting the air from the pipes.

from central news distributing agencies to the different newspapers in a city. Large tubes are also employed to carry mail and packages about large post-offices, and between post-offices and railway stations. In a three-inch tube a loaded carrier will travel 1,000 yards a minute under a ten-pound pressure, and the speed on other tubes varies according to the size of the tube, load, and pressure used.

If you blow across the surface of a dish of water, you know that the blast carries off a quantity of water in a fine spray. This fact is used in instruments commonly called "guns" to spray liquids. A blast of compressed air crosses the substance to be sprayed, and a nozzle directs the spray. Paint and cement are often applied to surfaces in this way, and the "sand blast" is used to direct a stream of sand against the sides of buildings to scour off grime and dirt. Artists use a similar device called an "air brush" to apply black, white, or gray coloring matter to pictures to blur outlines or to provide a cloud effect over the surface.

Compressed air can also be used to drive pistons in cylinders, just as steam is in the steam-engine. The pneumatic hammer and pneumatic presses and drills are examples of this use of air. In hammers the compressed air is applied to each side of a piston in turn, and some types will deliver as many as 20,000 blows a minute. In pneumatic presses the air is applied to a plunger, while other devices employ small motors geared to the working tool. Compressed air locomotives are often used in mines, ammunition factories, and other places where steam or electric locomotives would be dangerous or undesirable. Compressed air is also used as a cushion, the automobile tire being the most important example.

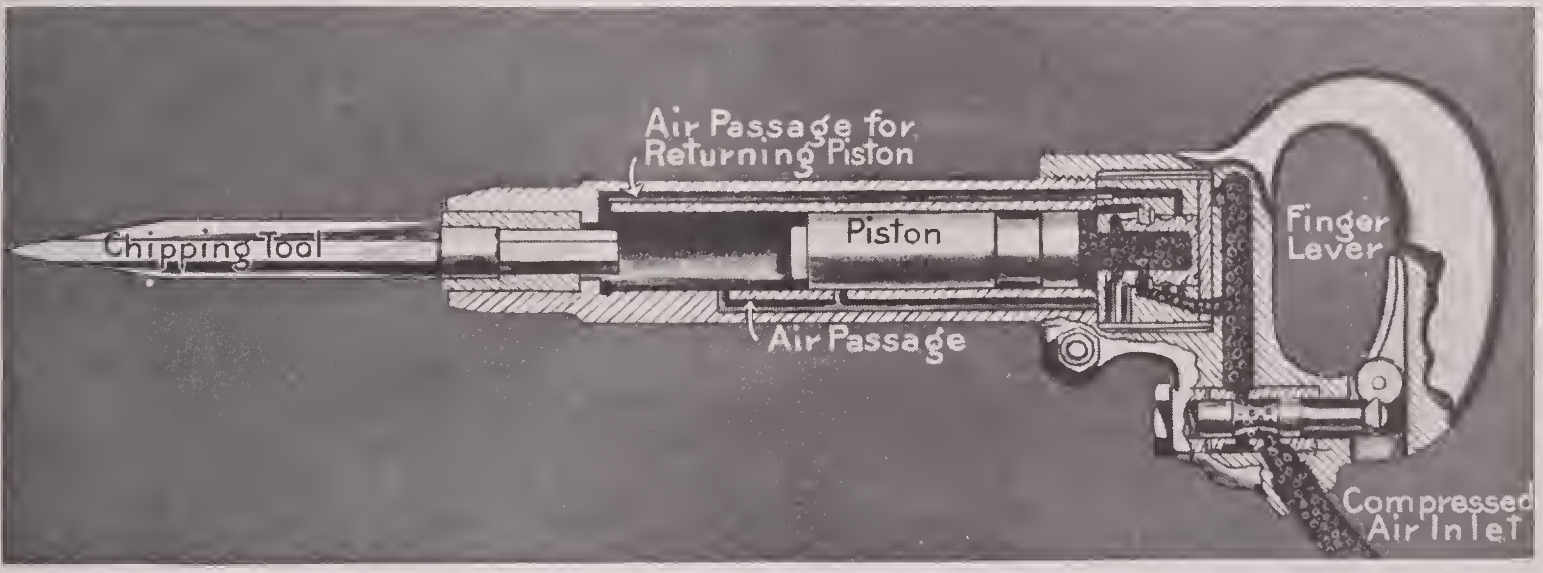
If compressed air be driven into a water-filled tunnel or an inverted cuplike chamber under water, the pressure of the air will keep the water out, and provide a space in which men can work. Compressed air is largely used in this way in driving foundations and tunnels through watery soil, under rivers, and in making foundations for structures like lighthouses and bridges. (*See* Tunnels.)

The general principles concerning the behavior of gases like air when compressed, reduced in pressure, or flowing about in response to various forces, make up a branch of Physics which is known as Pneumatics. (*See* Air; Physics.)

A DRILL OPERATED BY AIR

To run a drill like this requires an air pressure of about 75 to 80 pounds to the square inch. The compressed air is fed into the machine through a flexible rubber tube or hose.

THIS HAMMER DELIVERS OVER 1,500 BLOWS A MINUTE



A touch of the finger operates the lever at the right, and lets compressed air into the chamber back of the piston. This drives the heavy piston hard against the chipping tool. While the piston fires forward, the position of the valves in the rear is automatically changed, so that the air now rushes through the upper passage and drives the piston back. At the same time, the air in the main chamber, back of the piston, is allowed to escape. When the piston reaches the rear, the valves shift again and it is once more driven forward. So rapid is this back-and-forward motion that it sounds like a continuous buzz rather than single blows.

PO RIVER. Rising high in the Cottian Alps in the extreme western border, Italy's largest river is a mountain torrent in the first stage of its 420-mile course to the sea, and falls more than 5,200 feet in only 21 miles. Fed by the "aged snows" of the Alps, and by tributary streams, it widens to 425 feet as it nears the busy city of Turin, and moves more slowly. At last, winding sluggishly across "fruitful Lombardy, the pleasant garden of great Italy," it at last finds its way around its huge delta into the Adriatic.

With fine sediment that the river carries from the Alps and from the Apennines, it increases the area of its delta about 175 acres every year, so that some towns once on the coast are now several miles inland. It also keeps raising its bed, which is in many places above the level of the surrounding country. The resulting floods (despite the many dikes that have been built from Cremona to the delta, some of them of unknown antiquity) often prove disastrous.

The volume of water discharged by the Po almost equals that of the Rhine. Because of its great volume and width it is a hard river to cross, and its commercial cities such as Piacenza and Turin are found where there are the easiest fords. This great river, teeming with salmon, shad, sturgeon, and other fish, as it flows through Piedmont, Lombardy, and the southern edge of Venetia, has a drainage basin covering most of northern Italy.

POE, EDGAR ALLAN (1809–1849). In the annals of literature there is no more dark and disastrous career than that of this American poet and story writer whose inherent faults of character and bad training combined to quench in early death a truly fine and original genius.

From his mother, an English actress, and his father, a stage-struck youth of Baltimore, who left him an orphan in infancy, Poe inherited a highly nervous and emotional temperament, that needed the kindest and wisest oversight. Instead, the handsome precocious boy, alternately indulged and treated with severity, was brought up as the spoiled heir to the fortune of his godfather, John Allan of Richmond, Va., who adopted him. Then, after he had been taken from Virginia University and expelled from West Point Academy for his dissipated habits and insubordination, Mr. Allan disowned and disinherited him. At 25, with the expensive tastes of a gentleman and no training for a profession, Poe was obliged to live on the charity of his father's poor sister, a Mrs. Clemm of Baltimore. There he took local prizes for prose and verse, and discovered literary talents for which he found employment in Philadelphia and New York. A man of striking personal appearance, charming manners, and obvious gifts, Poe readily secured positions on the leading magazines of the day. But his weakness of will and occasional dissipations made him undependable and kept him in poverty. Yet in intervals of deadening hack work, Poe wrote short stories and verse, which, while small in amount, are among the most precious of American literary classics.

In poetry his genius was unique. He makes no appeal to the intellect but, as a result sometimes of his own morbid state of mind, expresses a melancholy sensuous emotion in verse, whose perfection of melody suggests fine musical compositions. His prose stories are different, but have an equal fascination. He gives form to horror and fear, or constructs and unravels mysteries with fidelity to scientific principles. Poe was more truly a world author than almost any other creative American writer; but so purely his own was his inspiration that he would have appeared a literary alien in any country. In the United States there is greater appreciation of his poetry than of his prose; while in France especially his short stories are classic models, on which famous writers have formed their style. A conscientious literary artist, he revised and perfected everything he wrote, and only by infinite painstaking secured his effects of spontaneity. The publication of 'The Raven' made him the literary lion of the day; but good was followed by ill fortune. He had married his cousin, Virigina Clemm, a beautiful girl and the "sainted maiden" of 'The Raven'. Two years after the appearance of this famous poem, his idolized young wife died, after a long decline and amid the tragic privations of poverty. In grief and remorse Poe made a heroic effort to conquer his weakness, but he died wretchedly in a Baltimore hospital.

Poe's chief works are: 'Tamerlane and Other Poems' (1827); 'Poems' (1831); 'Narrative of Arthur Gordon Pym' (1838); 'Tales of the Grotesque and Arabesque' (1840); 'The Raven and Other Poems' (1845); 'Tales' (1845).

POET LAUREATE. As the laurel tree, in ancient Greece, was considered sacred to the god Apollo, patron of poets, the custom arose of crowning poets who had won distinction with a wreath of laurel. Later the same practice was followed in Italy, where Petrarch and Tasso received this honor. In time the word "laureate," which meant originally "crowned with laurel," came to mean honored or eminent.

The title "poet laureate" is given in England to the poet attached to the royal household. From very early times it was the custom of the English kings to include poets or minstrels in their retinue. Instead of being crowned, however, they were granted pensions as a mark of royal favor. Such a pension, together with a pitcher of wine daily, was granted to Chaucer in the 14th century; and Spenser in the 16th century was honored in a similar manner. Ben Jonson (1619–1637) was probably the first to hold a regular office as court poet, and he was succeeded by Sir William Davenant in 1638. John Dryden, who held the office from 1670 to 1689, was, so far as is known, the first to receive the official title of Poet Laureate. The salary is only about £100.

Dryden's successors, with their terms of office are: Thomas Shadwell (1689–1692); Nahum Tate (1692–1715); Nicholas Rowe (1715–1718); Laurence Eusden (1718–1730); Colley Cibber (1730–1757); William Whitehead (1757–1785); Thomas Warton (1785–1790); Henry James Pye (1790–1813); Robert Southey (1813–1843); William Wordsworth (1843–1850); Alfred Tennyson (1850–1892); Alfred Austin (1896–1913); Robert Bridges (1913–).

POE AT WORK UNDER CATALINA'S EYE

CHAS. SHELDON.

Poe did much of his early work at night in the simple living room of the cottage in which he lived with his aunt. At the plain wood table he would conjure up those tales of imagination or dream those musical poems on which his fame rests, while his pet cat Catalina perched on his shoulder. Mrs. Clemm, a woman in her sixties, would sit by the fire, and now and then would wake from her doze to warm Poe a cup of coffee.

The MAGIC *of* POETRY *and the* POET'S ART

How the Moods of the Spirit are Caught and Passed On by the Music and Witchery of Words

POETRY. Have you ever noticed what happens to you in the spring, when the sun begins to be warm on your neck, and the air has that funny tingle to it? You don't want to talk then, just the ordinary words. They don't say enough for you. They are too dull and everyday. You want to shout and sing, and make queer noises that don't exactly make any words but that somehow mean more to you than words. It's the same in the autumn at twilight. Only then you don't feel happy, but queer and sad. You want to sing sad little songs and be as miserable as can be.

What you want then is poetry—either poetry or music. Prose—words put together in the ordinary way—is all right to say what you *think*, but when you want to say what you *feel* you need something with rhythm to it, something that says more than the words by themselves can possibly say. For words are half-dead things and can only really explain a part of our mysterious feelings and dreams.

When Robert Louis Stevenson writes:

> The world is so full of a number of things
> I'm sure we should all be as happy as kings,

it's not just what he says, but what he suggests without really saying it that makes you like it so much. It's the "number of things" you yourself know about and can imagine in the poem that makes it what it is. For what poetry and music do to words is to add to them, by suggesting things they can't say, just those mysterious feelings and dreams which are inside of every person who hears them.

The Music in Poetry

In the beginning poetry and music always went together and could hardly be separated. An Indian, if he got so excited about a war, or so in love—everybody writes poetry when he is in love—that ordinary words didn't satisfy him, broke into a chant that had both words and music. Even in much more highly developed civilizations like the Greek almost all the poetry had a sort of chanted tune that was composed by the poet himself. In China today all poetry is recited in a queer sing-song tune that the reader makes up as he goes along.

But by and by the two began to be separated, and now poetry stands by itself. But in good poetry the reader should always be able to hear in his head the echo of the tune that might be there. Sometimes people say that it's this tune, or rhythm, which makes poetry different from prose. But that isn't thinking far enough back. The rhythm isn't there accidentally. The poet uses it because something in him makes him use it, and it's this something that is the real difference. In the main the difference is this, that poetry is written when the feelings of the poet are red-hot, and prose usually when a man is thinking much more quietly.

All the outward signs of poetry, like a pronounced rhythm, meter, rhyme, alliteration, etc., come from this inner heat in the poet. Another important distinction which comes from the same heat is that good poetry is much more condensed than prose, and, by leaving out the unimportant things, it uses fewer words to say the same thing. Take for instance the beginning of the 'Rime of the Ancient Mariner'. Anyone writing that in prose would probably have told the mariner's name, where he came from, where he was, who the man he stopped was, and a dozen other things. But Coleridge doesn't care about these things. He feels the story too strongly. So he only writes:

> It is an ancient Mariner
> And he stoppeth one of three—

and you never miss the other things for a minute.

The Simplicity of the Best Poetry

Poetry is at its best when it is written in simple language such as everyone can understand, like this charming poem by A. E. Housman, which hasn't a single "fancy" word in it:

> Loveliest of trees, the cherry now
> Is hung with bloom along the bough,
> And stands about the woodland ride
> Wearing white for Eastertide.
>
> Now, of my three score years and ten,
> Twenty will not come again,
> And take from seventy springs a score,
> It only leaves me fifty more.
>
> And since to look at things in bloom
> Fifty springs are little room,
> About the woodlands I will go
> To see the cherry hung with snow.

If you will look at this poem carefully you will see that the poet has used several ways of decorating the idea with which he began, just as people decorate a dress with a ribbon, or a table with flowers. These decorations all have names, and a poet may use as many or as few of them as he chooses. But remember that it isn't the decorations that make the poem.

Forms of Decoration in Poetry

The decoration most often used is called *meter*. The poet has arranged his words so that the rhythm is regular, the lines are of regular lengths, and the poem goes with a regular swing like a song. The next decoration is *rhyme*, which makes the last words of the lines echo each other. The next decoration in the cherry-tree poem is called *refrain* or *return*. The poet has used again for the last line an idea first written in the second line, though here the words are a little different. Often the words are exactly the same. *Return* gives to the poem an effect of being a round and single whole. Other decorations used in poems are *metaphor*, *simile*, *alliteration*, *personification*, etc. (*See* Figures of Speech.)

Although the language of poetry should be simple, the subject can be anything under the sun, if only the poet sees it through his heart and not only with his eyes. Robert Burns has a well-known poem about a louse, and nowadays the poets are writing about subway trains and factories and other things that used to be thought very prosy.

There are three principal sorts of poems, *lyric*, *dramatic*, and *epic* poems. The word lyric comes from "lyre," the old musical instrument, and it really means a poem that can be sung. In lyric poetry the poet writes his own feelings and dreams. Housman's cherry-tree poem is one of the best modern lyrics. Dramatic poetry builds a drama or play. Shakespeare's plays are probably the best dramatic poetry in English. Epic poetry tells long stories of heroes and adventures, like Homer's 'Iliad' and 'Odyssey'.

Varieties of Lyric Poetry

Epic and dramatic poetry are usually much alike in form, but lyric poetry is divided again into a large number of classes. Almost all the short poems you see are lyric poems of one sort or another. One of the oldest of these forms is the *ballad*, which tells a story as epic poetry does, but much more simply and concisely. The *ode* is a form in which the poet writes of, and praises, some beautiful or moving thing. The *elegy* is a song of grief for the dead. The *sonnet*, *villanelle*, *rondeau*, *triolet*, and others are forms in which the words and lines are arranged in very definite patterns. Poems of this last sort are rather apt not to be very good poetry, because the form grows so important that it often swallows up the substance. Free verse (*vers libre*) is a very old form—the psalms in the Bible are written in it—which has come to be used a great deal lately, and which came into use again because so many of the other forms do kill the substance by making the form too rigid. In free verse meter and rhyme are not used, but return, metaphor, alliteration, and other decorations are. Free verse is best at description. Blank verse is sometimes confused at first with free verse, but it is really quite different. Blank verse uses a regular meter, and a regular line length, but it is not rhymed. It is a very stately form.

Poetry has been analyzed and classified by those who study it. The poets themselves seldom give much thought to this analysis. They write a poem a certain way because they feel it that way. And people who read the poems need not be able to analyze them either in order to enjoy them. But the names they use are useful to know if you want to describe a particular poem.

Different Kinds of Meter

Most of this analysis is about the decoration called meter. Meter is the regular arrangement into lines of long and short syllables, or accented and unaccented syllables, as some call them. These syllables are grouped, and each little group is called a foot. A foot nearly always has one long or accented syllable and one or more short syllables. The principal exception is a foot called the *spondee*, which has two long syllables. The most common meter in English is called the *iambic*, in which each foot, called an iambus, has one short syllable followed by a long. A foot that has a long syllable followed by a short is called a *trochee*. A *dactyl* is a foot with one long syllable followed by two short, and an *anapest* has two short followed by a long. A line with five feet, which, when it is analyzed or "scanned" looks like this—

| Thou̮ wa̱st | no̮t bo̱rn | fo̮r dea̱th, | i̮mmo̱r|ta̮l bi̱rd! |

is called a *pentameter* line. Blank verse is a series of such lines, unrhymed. A line is called *hexameter* when it has six feet like this:

| Thi̱s i̮s the̮ | fo̱re̮st pri̮m|e̱va̮l; the̮ | mu̱rmu̮ri̮ng | pi̱nes
a̮nd the̮ | he̱mlo̮cks. |

When lines are divided into groups, each group is called a stanza. A rhymed stanza of two lines is called a couplet. The "heroic couplet" has two iambic pentameter lines. A group of four lines is called a quatrain. The "heroic quatrain" has four pentameter lines of which the first and third rhyme, and the second and fourth. The "common meter" of the hymns has a stanza of four lines of which the first and third, which rhyme, have four iambic feet and the second and fourth, which also rhyme, are shorter and have only three feet. And there are many other names and divisions. But you must never let these hard names trouble you. They are only outside things and don't matter much either to the poet who writes the poems or to you who read them.

POINCARÉ (*pwăṅ-kä-rā'*), RAYMOND (born 1860). "A small man with a clear eye, a strong hand, and a steady head"—that is a description of Raymond Poincaré, president of France during the World War of 1914–18. Of all the French statesmen who conducted the affairs of the republic during the opening years of the 20th century, none had foreseen more clearly than he the impending struggle with Germany, and few had done more to prepare the nation for that conflict.

Born in Bar-le-Duc, on the borders of the lost province of Lorraine, in 1860, he had studied law in Paris and rose to high rank in his profession. He soon plunged into politics, adopting moderate republican policies. At the age of 33 he became minister of public instruction, and the following year minister of finance, winning high distinction despite his comparative youth. In 1903 he left the Chamber of Deputies for the French Senate. Then in 1912, at a time when relations with Germany were in a critical condition over Morocco, Senator Poincaré was called upon to form an administration as prime minister, in which he himself took the post of minister of foreign affairs. He cemented the friendship of France with Great Britain and Russia; and when he was elected to the presidency in 1913 he threw his support behind the three-year military service bill as an answer to Germany's alarming army increases. It was his policy to extend the influence of the president's office, which in the past had become little more than an honorary post in the French government.

From the time the storm broke in 1914 until the end of the war, President Poincaré proved a steadfast influence toward victory, aiding every effort made by the responsible civil and military officers. Day by day he drove about the streets of Paris, visited the families of those injured in air raids, called at the hospitals, spoke at public gatherings—always inspiring confidence.

At the end of his seven-year term in 1920, Poincaré did not think it beneath his dignity to return to his seat in the Senate and devote his unflagging energies to aid France in the work of reconstruction and in exacting from Germany the fullest measure of reparation.

Poincaré came of a distinguished intellectual family. His brother Lucien became a distinguished physicist, and his cousin Henri was a world-famous mathematician. Raymond Poincaré wrote a number of works on political science, including one entitled, in its English translation, 'How France is Governed'.

The POISON BEARERS *of the* PLANT WORLD

They are Much More Common than Most People Imagine—Some Notable Examples

POISONOUS PLANTS. Every plant in the world has to protect itself if it is to survive, for there are enemies all about it. These enemies may be grazing animals, or the even more dangerous and destructive insects and fungi. One of the commonest forms of defense is the development of certain qualities within the plant itself which act as protective agents. At times these take the form of thorns, in other cases of evil-smelling substances, and in some instances of poisons which are contained in large enough amounts to make the plants injurious when eaten or even touched.

Among the commonest North American plants which are poisonous to the touch are poison ivy, poison oak, and poison sumac. Contact with any of these is almost sure to cause severe inflammation and an intolerable itching, although people are affected in varying degrees.

BLACK HELLEBORE

This plant gets its name from its black rootstock. Its flowers are first white, sometimes tinged with red, but later turn to green. The leaves are evergreen. Hellebore is a corrosive poison.

Poison ivy (*Toxicodendron radicans*), which grows abundantly throughout the United States as far west as eastern Texas, eastern Kansas, and Minnesota, is the most widely distributed. It is found climbing up the tall trunks of trees and in and out among the bushes along the road, luxuriating in fence corners, and even thriving in wastes of sand where little other vegetation can exist. Usually it is a trailing three-leafed vine, clinging to its support by a thick fringe of aerial rootlets that appear at intervals along the stem, although sometimes it assumes an upright shrubby growth. Its fresh shining foliage, a charming green even in the driest hottest days of summer, changing in the autumn to rich glowing shades of scarlet, delights the most casual observer; yet its beauty is as nothing to the suffering it causes every year to the thousands who inadvertently come in contact with it. Oddly enough, poison ivy has no apparent effect on animals.

The harmless Virginia creeper, or woodbine, is often confused with poison ivy, but the two are very dissimilar. The Virginia creeper is a stronger larger vine, it has *five* leaflets instead of *three*, climbs by tendrils instead of aerial rootlets, and the clusters of berries are dark blue instead of waxy white.

The poison ivy poison, an oil called toxicodendrol, is found in all parts of the plant, and cases of poisoning can develop at all seasons of the year. It is dangerous to inhale the pollen of the small green flowers which appear in May and June, and there have been instances of poisoning from the smoke of a bonfire of ivy brush. Very hot soap suds or sugar of lead will relieve the suffering.

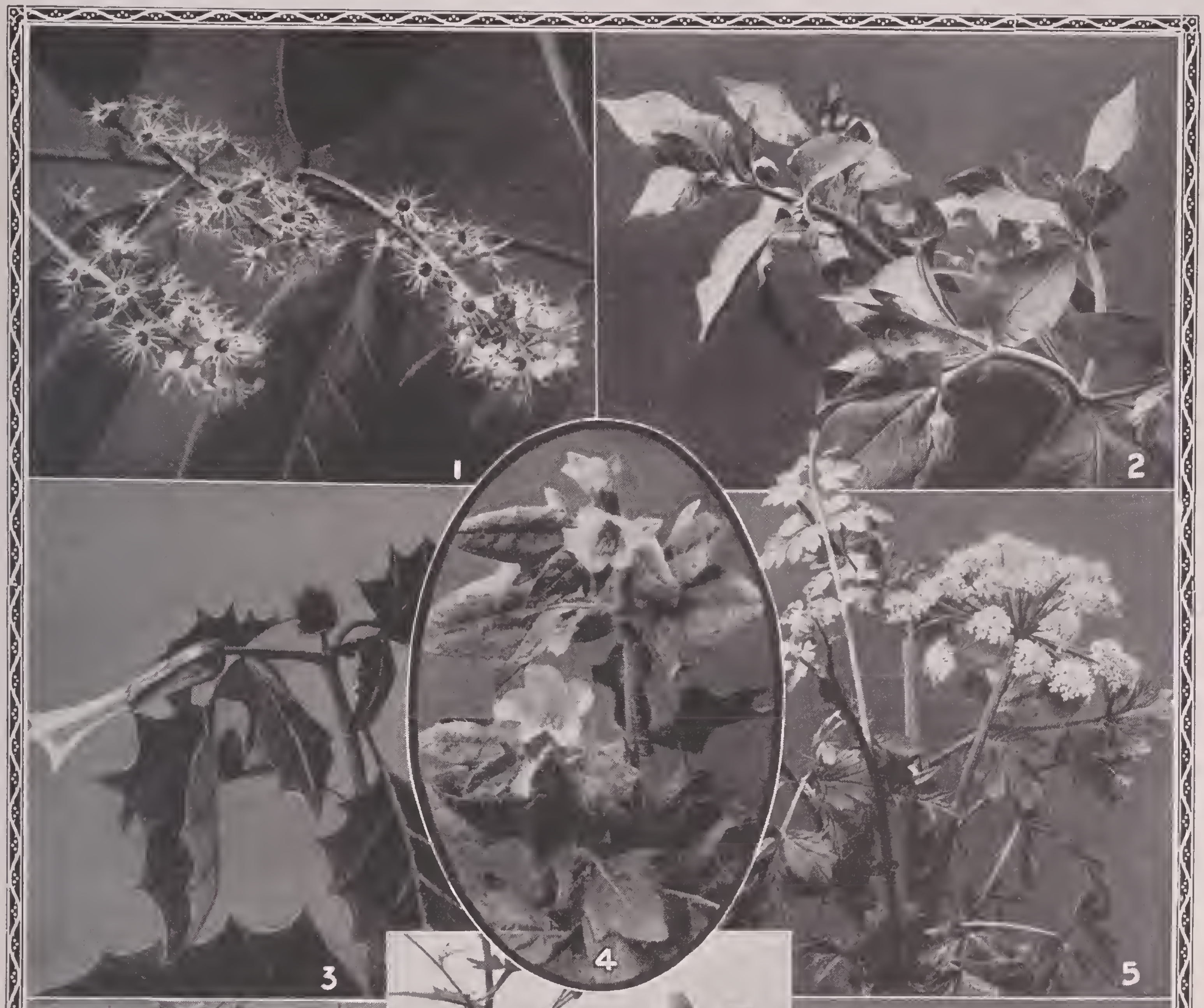
Farther west, the poison ivy is replaced by the so-called "poison oak," a plant of the same genus, which differs from the poison ivy mainly in the character of its leaves. These are thicker and smaller and less sharply lobed, but the unpleasant effects of touching the plant are the same.

Another beautiful and poisonous member of the same family, the swamp or poison "sumac" or poison "dogwood" (*Toxicodendron vernix*), is to be found in swampy places from Florida to Canada and westward to Louisiana. The leaves of this shrubby plant which grows from 6 to 30 feet high are pinnate and resemble those of the true sumac of the hillsides and roadways; but the leaflets of the poison sumac are fewer, varying from 7 to 11 instead of from 13 to 30. The clusters of berries are ivory white.

A few other plants, not so common, cause skin irritation to some people. Among these are the handsome lady's-slipper growing in sphagnum moss swamps. The juice of several of the spurges (*Euphorbia*) causes similar inflammation.

Plants containing substances in their foliage, roots, or fruits, which are poisonous to mankind, are scat-

POISONS THAT GROW IN FIELD AND FOREST



All of the plants shown on this page have been used at some time as medicines, but in large doses they are active poisons. Some of them kill horses, cattle, and other animals, but are seldom fatal to human beings because the latter are not likely to absorb enough of the poison accidentally. The plants are (1) Cherry-Laurel; (2) Deadly Nightshade; (3) Jimson Weed or Stinkweed; (4) Henbane; (5) Water Dropwort; (6) Common Yew; (7) Monkshood or Aconite; (8) Larkspur. The roots of Henbane, Water Dropwort, and Monkshood are poisonous; of the other plants the fruit or foliage is dangerous.

tered all through the vegetable kingdom, and the line between such poisonous and non-poisonous plants is not sharply defined. Some harmless plants contain traces of poisons which, if concentrated, are deadly; the potato, which is one of our most wholesome food plants, though akin to the deadly nightshade, is in this class. The foliage or seeds of some of our loveliest and commonest garden flowers, such as the larkspur, clematis, lupine, and many of the lilies, contain poisons, but they are not dangerous because they are seldom or never eaten. The plants with poisonous fruits, including the pokeberry, bittersweet, nightshade, black cherry kernels, and the deadly "thorn apple" or "jimson" weed, cause the most harm, especially to curious children. Poisonous toadstools, mistaken for true edible mushrooms, are often the cause of death.

THE "WAKE ROBIN" OR TRILLIUM

Probably you have never eaten this pretty flower, one of the sure signs of spring. If you have, you were very unhappy, for the petals have a sweetish astringent taste and are strong emetics.

Live stock are often made ill by eating poisonous plants growing wild in the grazing pastures. The "water hemlock" (*Cicuta maculata*) is probably the most deadly of these, and in fact is the most poisonous of all our native plants. It is especially dangerous because the fleshy carrot-like root, in which the poison is most concentrated, is sometimes eaten by children. Even water in marshes where these roots have been crushed by trampling is poisonous to cattle. The "poison hemlock" (*Conium maculatum*), which really belongs to the parsley family, is the plant from which the poison was distilled with which Socrates was put to death. The beautiful evergreen mountain laurel, the rhododendron, the dainty buttercup, the sneezewood, rattlebox, and the silvery-white silky-leaved "loco" or crazy weed, are all harmful to live stock.

Many plants, when bruised and thrown into water, have the power of stupefying or killing the fish there. The bruised twigs and seeds of the red buckeye, for instance, thrown into small ponds, will bring the fish to the surface. Other poisonous plants are still used for this purpose by certain South American Indians. Poisoned arrows, used by savage tribes in almost every part of the world, were usually dipped in the poisonous juices of some plant, though snake venom and other poisons were also used. There are several trees in the tropics the bark of which exudes a poisonous sap when wounded.

POISONS. Popular accounts of certain periods of history are crowded with romantic and sensational stories in which poisons play a leading part. The Renaissance period in Europe, and particularly in Italy, is pictured as a time when tyrants and unscrupulous statesmen were much engaged in administering subtle death-dealing drugs to dangerous rivals and other inconvenient persons. They had poisons, we are told, which they had only to rub on paper, cloth, or metal to make these fatal to any who touched them, and they compounded delicate perfumes which brought lingering death to those who breathed their aroma. Next to the Italians, the mysterious men of India are ranked as leading inventors of murderous compounds. Fiction stories and sometimes newspaper reports relate tales of "strange Eastern drugs" which baffle modern science.

These and most statements of a similar character may be dismissed as purely imagination. It is not to be supposed that either the Renaissance Italians or the Hindus carried their knowledge of chemistry beyond what we know today. In fact, the ordinary drug clerk probably possesses information on the subject which might have brought lasting fame to any Renaissance poison-maker.

The Four Classes of Poisons

There is little mystery about poisons today. Although the action of many complex poisonous substances, like snake venom or the ptomaines, may not be fully understood, their general nature and their ordinary effects are known. The common poisons are usually classified according to the way they act upon the human body: (1) corrosive poisons, (2) irritant poisons, (3) nerve poisons, and (4) gas poisons. Substances which are used to counteract the effects of poisons are called "antidotes."

The corrosive poisons are those which "burn" the skin or lining of the stomach. Among the commonest and the most dangerous chemicals of this class is corrosive sublimate, often called bichloride of mercury, which is widely used as an antiseptic. It is prepared usually in the form of small white tablets, and is easily mistaken for harmless pills. For this reason it is unsafe to leave such tablets where other medicines or drugs are kept. The antidote is the white of eggs beaten up with water. Other common corrosives are sulphuric, nitric, hydrochloric, and oxalic acids, all of which act rapidly and powerfully if strong solutions are swallowed. The antidote for these is powdered chalk or even plaster from the wall. Carbolic acid is another corrosive poison which claims many victims. To counteract it, Epsom salts should be given, followed by sweet oil.

The irritant poisons are those which set up inflammation in the body and interfere so seriously with its functions as to cause severe sickness or eventual death. They are usually slower and more uncertain in their action than other poisons and for this reason harder to detect and to avoid. To this class belong most of the so-called cumulative poisons, those which can be absorbed little by little into the system without apparent harm, until suddenly they strike down their unsuspecting victims.

Arsenic and all its compounds are the most important of the irritant poisons. A tablespoonful of dialyzed iron at half-hour intervals is the antidote. Many lead, copper and zinc compounds also fall in this group. Aloes and croton oil are good examples of the vegetable irritants. Phosphorus, which is sometimes used for match tips, is among the dangerous chemicals of this class (*see* Matches). Ordinary gum arabic mucilage is a good phosphorus antidote.

The most deadly of all poisons, however, are those which act directly upon the nerves. Of these prussic or hydrocyanic acid is perhaps the best known. Less than a teaspoonful of a 2 per cent solution will cause death. The fumes of this acid are sometimes used to rid dwellings of germs or vermin (*see* Antiseptics). But only professional experts should ever attempt this, for one or two breaths of the fumes will kill almost instantly. Many cyanide compounds, especially cyanide of potassium, are extensively used in the arts. Most of these are just as poisonous as hydrocyanic acid.

Aconitin is an exceedingly deadly poison, which kills in very minute doses. It is derived from certain plants of the aconite family, some of which, such as the monk's hood and wolf's bane, are cultivated for their beauty; most of them are poisonous. Antidotes for this as well as for prussic acid are of little use, as the victim is usually dead before they can be applied.

Other common nerve poisons are opium and all its products, such as morphine and laudanum. The best treatment for these poisons is to keep the patient awake by shaking or even beating and by making him inhale ammonia fumes from time to time until a physician can be summoned. This applies equally to all narcotic poisons, such as cocaine, heroin, etc.

Belladonna and its alkaloid atropine, which is used by oculists to enlarge the pupils of the eyes for examination, is a nerve poison. This drug and morphine are antidotes for each other. Belladonna is obtained from a plant called the deadly nightshade, which has bright scarlet berries often attractive to children.

IT YIELDS A DEADLY DRUG

This is a twig of the tree called Strychnos Nux Vomica, which is a native of Asia. From its seeds strychnine is manufactured. This drug is used in very small quantities as a heart stimulant, but in larger doses is one of the deadliest of poisons.

Strychnine deserves especial warning mention in this group of poisons, because it is so frequently used to get rid of rats, and in the West to kill wolves, coyotes, prairie dogs, and other animal pests. Its effects are very rapid, resulting in convulsions and death within half an hour. Sodium bromide is sometimes used as an antidote. The best method is to keep the patient under chloroform until the poison has been eliminated.

Gas poisons may be divided into two classes: those which act as powerful irritants to the throat and lung tissues, like chlorine, bromine, the fumes of burning sulphur, and the nitrous vapors produced in copper engraving; and those which act on the blood through the lungs and render it incapable of conveying oxygen.

Ordinary coal gas, used for light and fuel, is, of course, the commonest of gas poisons. The poisonous effects are usually due to carbon monoxide, an important constituent. The treatment is fresh air, aromatic spirits of ammonia, or some other stimulant. Burning charcoal is also dangerous, because of the carbon monoxide it produces. Carbon dioxide, however, is not a true poison, for its effect is merely to cut off the proper air supply and smother the person who is submerged in it. (*See* Carbon Dioxide and Monoxide.) Gas poisons, principally of the irritant kind, played a large part in the World War of 1914–18. (*See* Gas Warfare.)

There are many other kinds of poisons, such as the ptomaines and botuline, created by the action of certain bacteria on improperly kept foods; and other bacterial poisons, like those which cause lockjaw. (*See* Antitoxins; Bacteria; Germ Theory of Disease.) Many animals and plants also secrete poisonous substances (*see* Poisonous Plants).

In dealing with all cases of poisoning from whatever cause, the first rule is to call a physician as soon as possible. While waiting for help, it is well to make the patient vomit by giving an emetic of powdered ipecac or mustard water, or even soap suds, except when the poison taken is lye, caustic potash, washing soda, or any of the corrosive acids. In all gas cases fresh air is the first requisite. Lung action may be aided by working the arms over the head and back. The best way to avoid accidents is to keep no poisons in the household, except when absolutely necessary, and then to have them locked safely away.

The PHOENIX *of the* NATIONS

How Poland Has Risen Again and Again from the Ashes of Destruction—Her Former Greatness, Her Dismemberment by Greedy Neighbors, and Her Resurrection after the World War

POLAND. What a kaleidoscope is Poland! For more than 400 years it was one of the vastest states of Europe, stretching illimitably over the flat expanse of forest, swamp, and plain that lies between the Baltic and the Black seas. It kept the Tatar hordes of the Russian steppes from the threshold of western Europe, and its king was at times the champion of Christianity against the Mohammedan Turk. Then came the twilight of old Poland and it was wiped absolutely off the map by the greed of its unscrupulous neighbors—Prussia, Russia, and Austria. Finally, a century and a quarter afterward, there dawned a new day for Poland, and it rose Phoenix-like from the flames and ashes of the World War. Its new leader was not a king or warrior or statesman, but a world-famous musician—Jan Ignace Paderewski! Where do we find a story more thrilling and romantic, or where a land of more poignant interest?

In the 18th century Poland was, next to Russia, the most extensive country in Europe. But its kings were elected by the nobles and at each successive election the power of the crown was diminished, so that in time the king became practically powerless. Poland had no ambassadors at foreign courts, no fortresses, no navy, no roads, no treasury, no fixed revenue. The officers of the government were appointed for life and could not be removed. The Diet, or legislative body, which had all power of making peace or war and levying taxes, was composed exclusively of representatives of the nobles. By what was known as the *liberum veto*, any one of these could rise and exclaim, "I disapprove," and so defeat any measure which came before the Diet. There was no middle class in the population of about 1,000,000 nobles and 13,000,000 serfs, and the peasants were "the poorest, most oppressed, and most miserable in the world." The estates of many of the nobles were so small that it was jokingly said that when the noble's dog lay down in the middle of the estate, his tail would extend beyond its borders.

A PEASANT WOMAN

This is a Polish woman of the poorer class. The wealthy women often wear bright red boots, especially when dressed in their "Sunday-best."

Poland's greedy neighbors to the east, west, and south blocked every effort to reform this state of affairs. Then Catherine II of Russia determined to seize a portion of Poland, and Frederick the Great of Prussia persuaded Austria to join him in forcing Catherine to share with them the booty. Thus began the "vast national crime," by which in three successive partitions—in 1772, 1793, and 1795—Poland was wiped off the map and its territories annexed to Russia, Prussia, and Austria.

The new Poland, as revived by the treaty of Versailles, in 1919, is mainly the vast bowl-shaped plain drained by the Vistula, which flows into the Baltic to the east of the "free city" of Danzig. The treaty gave Poland practically her old western boundary, with access to the Baltic, but certain districts (the Allenstein district of East Prussia, and Upper Silesia) were to vote

MEN AND WOMEN WORK SIDE BY SIDE

Where the fertile fields of Poland have been cultivated, the yield is rich, but under foreign rule the farmers were so handicapped that they could not afford modern methods of agriculture, but cut their crops with scythes.

by "plebiscite" on their inclusion; in both cases the vote when taken showed majorities in favor of continuing under German rule. The eastern limit was long left open, owing to the continuance of war with Bolshevist Russia, and the conflicting claims of the revived states of Lithuania and the Ukraine. When this boundary was fixed by treaty with Russia (March 18, 1921), it fell considerably short of the Polish boundary of 1774.

Despite long winters, wet springs, and much marsh area, the soil of the northern two-thirds of Poland is fairly fertile and most of it is cultivated. Rye, oats, wheat and barley, sugar beets, and potatoes are the principal crops.

Southern Poland, even without the rich coal and iron mines of Upper Silesia, has extensive mineral resources—brown iron ores near Kielce and Dombrowa, and elsewhere coal and lignite, zinc, tin, copper, and sulphur. Former Russian Poland, which included about six-sevenths of the restored republic, was rich in manufactures, especially of textiles, beet sugar, leather, and leather goods. Warsaw, the capital, a city rich in historic memories, is also a place of great industrial importance (*see* Warsaw). Lodz, second only to Warsaw, was one of the leading centers of cotton manufacture in the world. Cracow (*see* Cracow) is famous for its old university, and Posen (in the former Prussian portion) is noted for distilling and milling. Lemberg (Polish *Lwow*), in the former Austrian portion, has miscellaneous manufactures, a mid-winter fair, and an extensive commerce—largely in the hands of the Jews, who constitute one-fourth of the population.

The Polish villages of the country districts consist usually of two straggling rows of thatched one-storied stone huts, plastered with mud and turning their gable ends to the uncobbled street between. Sometimes the houses are white-washed and daubed with gay paints. If the village is large, there is a church—usually Roman Catholic, but often "Uniate" (Greek Catholic, though under the pope)—and a pond where geese, ducks, pigs, and babies wallow contentedly, and where the village laundry is done, even in mid-winter. Inside the houses there are usually two rooms. In the first, the "hot room," the whole family, sometimes several generations, eat, sleep, and work. Its few pieces of furniture are wooden benches and tables, their originally glaring colors mellowed by smoke and dirt; and an enormous brick stove reaching almost to the ceiling, in which logs and blocks of manure are burned. The windows let in light but never fresh air, and above the stifling heat and stuffiness is an overpowering odor of sour cabbage and garlic-flavored beet-root stew. From the other room, the "cold room," there emerges at daybreak a procession of perhaps two cows, a pony, surely several dogs, some pigs, and much poultry.

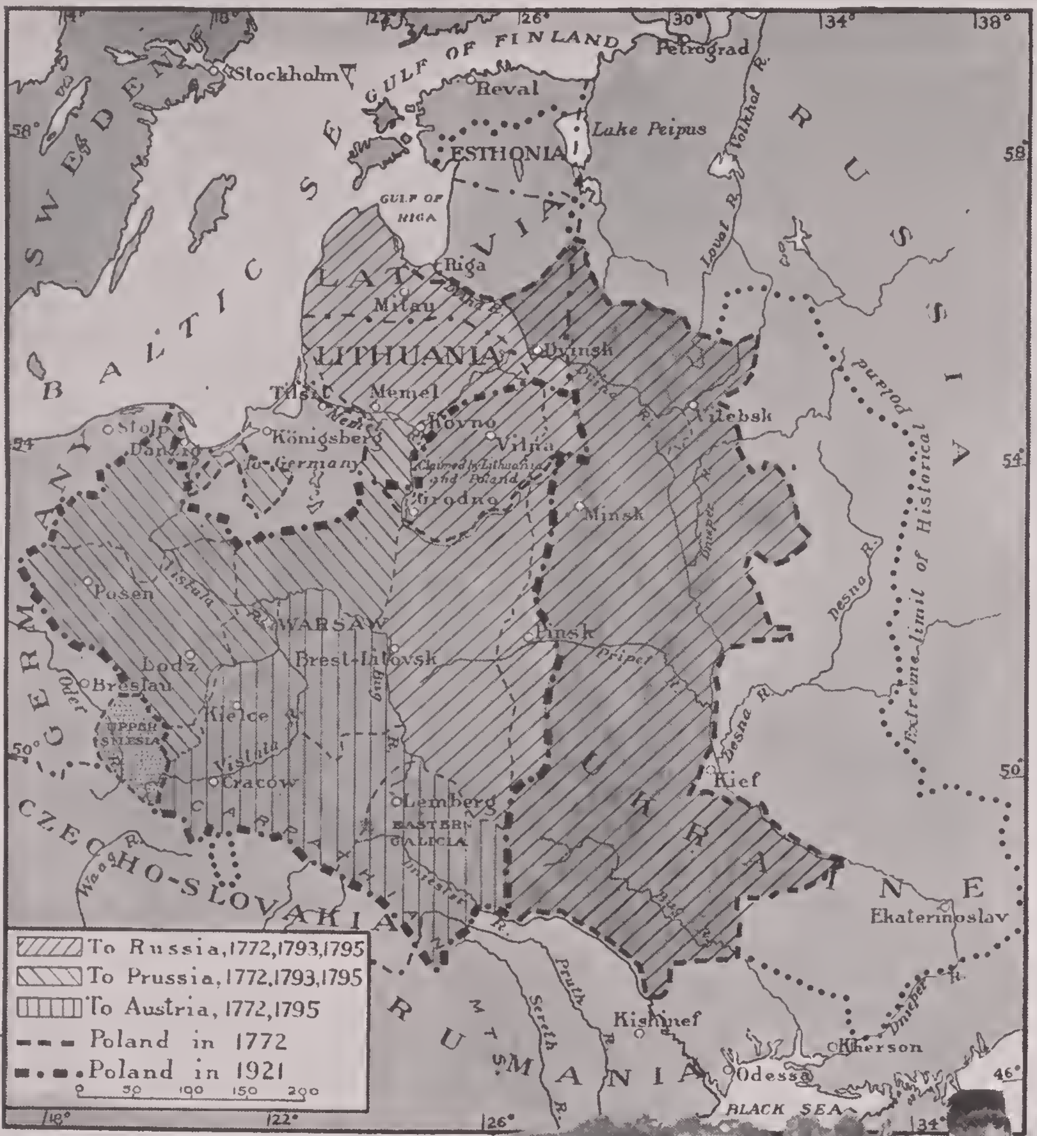
The peasants are of Slavic stock more or less mixed with other races. Their costumes are often very picturesque. The men usually wear buff woolen breeches, a jaunty short coat decorated with scarlet and blue ribbons, and a small round black felt hat. Their sweethearts appear wrapped in a flaming rose and yellow shawl, beneath which you catch glimpses of an embroidered green velvet bodice and a full white linen skirt reaching barely to the knees, with high-

"THE COSSACKS ARE COMING!"

In the days of Russian rule, when the inhabitants of a Polish city rose in protest against oppression, the reply was often the brief order: "Send the Cossacks!" And presently down the streets would gallop a band of these wild and ruthless horsemen, armed with whips or with sabers drawn. Through the town would ring the cry of terror: "The Cossacks are coming!" while the people ran for shelter. And so with lash or steel the Poles were beaten into submission. In this picture we see such a scene. In the foreground a terrified mother turns away from what seems certain death for her child, but a gallant passer-by, even under the horseman's blows, saves the little girl.

heeled boots of crimson leather stitched with yellow. They wear beads of every hue, long silver earrings, and bright-colored kerchief head-dresses which lend additional glory to their costume and bring out the ivory-tinted pallor of their small oval faces and the dark brightness of their long-lashed eyes.

POLAND—DIVIDED AND REUNITED



The map shows how Poland was wiped off the map by the three partitions of 1772, 1793, and 1795, and how it was restored after the World War. At the right we see a typical Polish peasant, one of the men who form the backbone of the nation, on his way to market.

There are many Jews in Poland, nearly three million of them, dating from the days when there was no middle class but only landed nobles and oppressed serfs. So Jews became the inn-keepers, peddlers, money-lenders, store-keepers, artisans, factory workers, and commercial travelers of the land. And, very unfortunately for Poland, in most cases the Jews are a separate class—distinguished by their dress and customs as well as by their religion—from which fact have come "pogroms" and massacres of Jews, in part based upon suspicion of lack of patriotism in the World War.

Many of the finest specimens of Polish manhood and womanhood perished, alas, in that world conflict. Two and one-half million Polish-speaking soldiers fought one another in the armies of Austria, Prussia, and Russia, while the country itself, one of the "granaries of Europe," became a ruin. The Germans treated Russian Poland like a second Belgium. Factories were dismantled and the machines removed to Germany; people were deported in crowds; millions of horses and cattle were confiscated or slaughtered; two consecutive crops were burned. Large districts were thus depopulated completely by cold, exposure, disease, and starvation.

But the Polish Spirit Survived

The spirit of Poland they could not kill or coerce. In the new Poland still lives that idealism which sent John Sobieski and his warriors in 1683 to battle for Christianity against the Turk before the walls of Vienna, saving Western Europe from the blight that comes with the Ottoman; and which brought Kosciuszko to Washington's aid in the American Revolution. And it is not warriors only that Poland has given the world. Her intellectual and artistic life has kept steadily on. Think what has been Poland's contribution to beauty and knowledge in the genius of Mickiewicz, her immortal poet; of Sienkiewicz, whom we know best as the author of 'Quo Vadis' and 'With Fire and Sword'; and Joseph Conrad, one of the master story-tellers of the English language. Recall that Madam Curie, the co-discoverer of radium, is a Pole; and that to this same race belongs the composer Chopin, the pianist-composer Paderewski, the singer Sembrich, and Modjeska the actress, together with hosts of other persons eminent in one or the other of the arts.

Poland (whose name comes from a word meaning "plain") became a Christian kingdom about the beginning of the 11th century. From the 13th century onward there were wars with the crusading order of Teutonic Knights, who had colonized the Baltic coast, and with the Mongols who then ruled Russia. The area of the kingdom was more than doubled when Poland and the Grand Duchy of Lithuania were united by marriage under the house of Jagellon, in 1386. After some wavering, Poland remained Catholic at the time of the Reformation. John Sobieski, who relieved Vienna when besieged by the Turks in 1683, is the great national hero of Poland.

When the Jagellon line of kings died out in 1572, Poland became an elective kingdom. The practice of election, together with the selfish policy of the nobles, their possession of the *liberum veto* (right of any noble to forbid any law he did not like), the degraded serfdom of the mass of the people, and the absence of a middle class, paved the way for the partitions of Poland by Prussia, Russia, and Austria in 1772, 1793, and 1795. Napoleon's short-lived Duchy of Warsaw (1807–15) proved a limited and temporary revival. An attempted revolution in Russian Poland, in 1830–32, was put down with great cruelty. At the outbreak of the World War in 1914, the former Polish territory was divided as follows among the powers: Russia, 45,000 square miles (11,000,000 inhabitants); Germany, 22,500 square miles (4,000,000 inhabitants); Austria, 11,000 square miles (5,000,000 inhabitants).

Poland today is a republic with an area of about 150,000 square miles, equal to that of Illinois, Pennsylvania, and New York put together, and a population of about 30,000,000. The constitution adopted in March 1921 abolished all distinctions of rank, provided for protection of religious minorities, and arranged for breaking up the great estates so that the peasants shall own their own lands. The government is modeled chiefly on that of France, and consists of a Parliament of two houses elected by the people (including women), and a president chosen by the Parliament. The actual administration is in the hands of a prime minister and cabinet, who are responsible to Parliament.

The ROMANCE *and* TRAGEDY *of* POLAR EXPLORATION

Far in the frozen North a handful of heroic men are struggling onward toward the Pole. The cold is terrible, 50 degrees below zero. A hurricane is blowing, hurling bits of ice and snow against the frozen cheeks of the men. In their heavy furs they stagger on, slipping on the ice, crossing crevasses where the least misstep means certain death. Their supplies of food are only the barest amount that can sustain life. And yet, because of the courage which is in them, they will not turn back. In quest of the Pole men have laid their bones along the Arctic and the Antarctic shores for centuries. They have faced untamable nature in her last stronghold and they have conquered. Such is the spirit of Polar Exploration.

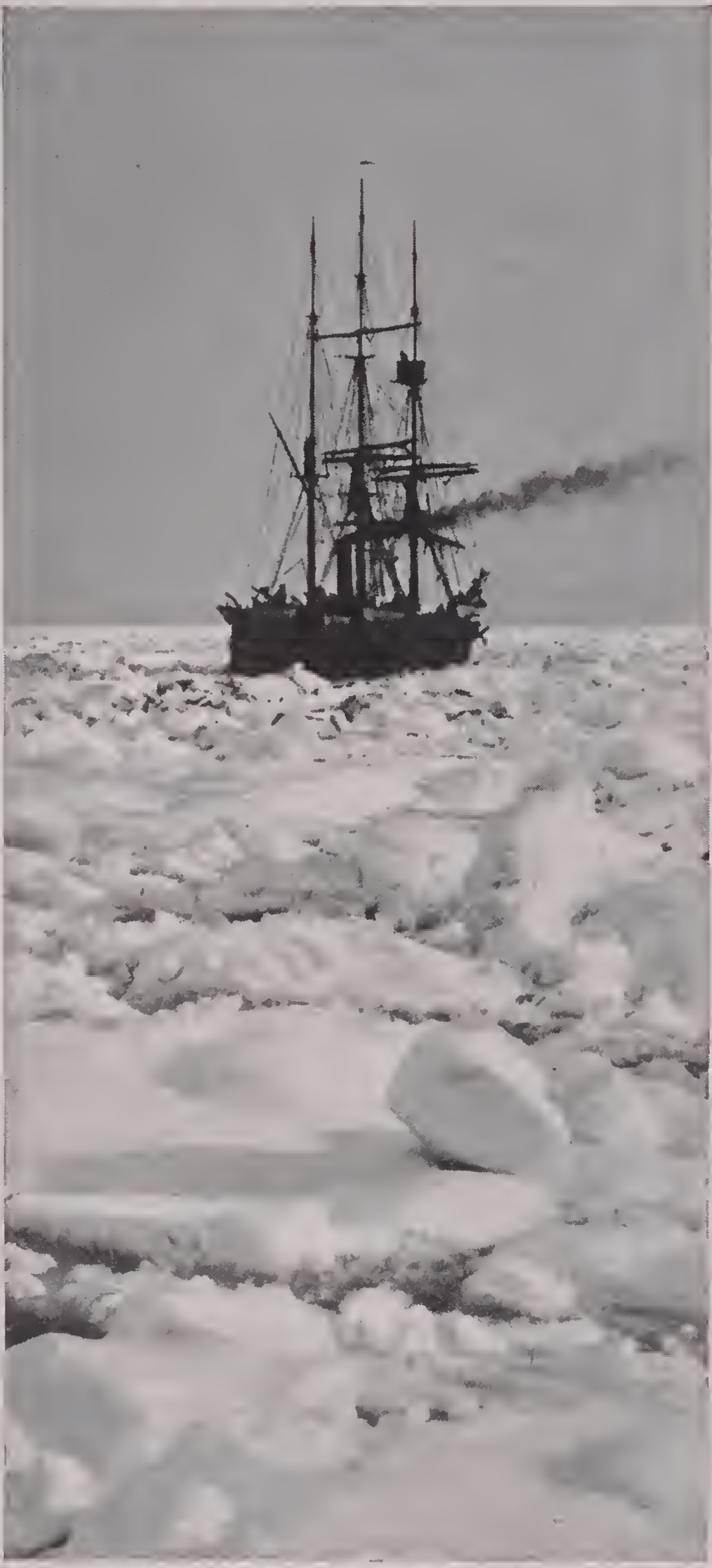
POLAR EXPLORATION. The history of polar exploration goes back many centuries. It starts perhaps with Ottar, that friend of King Alfred of England who with his Northmen discovered the White Sea, and with his yet more venturesome countryman, Eric the Red, who discovered Greenland a century later. From those early days to this, the great frozen spaces about the poles have called men to heroism and death, and their trails have led over ice-pack and glacier, through strange waters and over ice-bound mountains. (*See* Arctic Regions.) Many nations have contributed leaders to these explorations or equipped their costly expeditions—Norway, England, Portugal, Holland, Russia, Sweden, the United States, Germany, and even Austria-Hungary and Italy. So many are the gallant men who have taken part in the work of polar exploration that not even their names can here be given; only the greatest of the expeditions and achievements can be touched upon.

In the exploration of the north polar regions one of the first of the great names is that of Sir Martin Frobisher, a courageous gentleman of Queen Elizabeth's day who believed the polar seas were full of devils, but none the less sailed into them and discovered Frobisher's Bay on the coast of Arctic America. He didn't find the "northwest passage" to China, for which he was looking, but he was one of the founders of the British Empire. After him came Davis and Baffin, Englishmen, and Bering, a Dane, whose discoveries you can see for yourself by looking on the map where they have left their names. Henry Hudson, another Englishman, also left an imperishable name in geography before he met his sad end. He and many who followed him worked for two great English trading companies, the Muscovy Company and the Hudson's Bay Company, which did a great deal for exploration.

Navigation in those days was very difficult, not only because of the tiny ill-fitted ships used, but also because of the woeful lack of knowledge of the day. Hudson wrote quite seriously in his log that his men had seen a mermaid. Everyone believed in devils and evil spirits, and, what was perhaps worse yet, the charts were all terribly wrong. Whole lands, invented out of whole cloth and drawn in the charts, confused navigators for centuries.

In 1831 Capt. John Ross found the north magnetic pole on the west shore of Boothia Peninsula. An ill-fated expedition headed by Sir John Franklin did more for polar exploration in the end than any other single factor in the 19th century. The expedition sailed from England in 1845 to find the northwest passage, and, after three years of hardships and disaster, came to an end on the shores of Boothia. The relief expeditions which were sent out to ascertain the fate of these men discovered and explored 7,000 miles of Arctic coast line. One of these expeditions was led by Capt. Robert McClure. His ship was lost off Banks Land, but he pushed on with his crew across the ice and was finally found and rescued by another expedition which brought him home to England in 1854. He had discovered and traversed, though not in the same ship, and partly across ice, a northwest passage; and for this feat he was knighted and a reward of £10,000 was granted him and his crew by the House of Commons.

IN THE FAR NORTHERN SEAS



Fast in the Arctic ice is this ship, one of those belonging to the exploring expedition led by Vilhjalmur Stefansson in 1913-1916 on behalf of the Canadian government. For months at a time the explorers' ships are held in the grip of the ice, waiting for the summer thaw which will enable them to push on.

In 1882 ten nations set up stations in the polar regions for simultaneous meteorological and magnetic observations. The American naval expedition under Commander A. W. Greeley did especially good work, but many of the men paid with their lives. The relief ships failed to come till the expedition had been three winters in the frozen loneliness. Out of 24 men all but Greeley and six others died of the hardships; but they kept their records, their instruments, and their splendid collections.

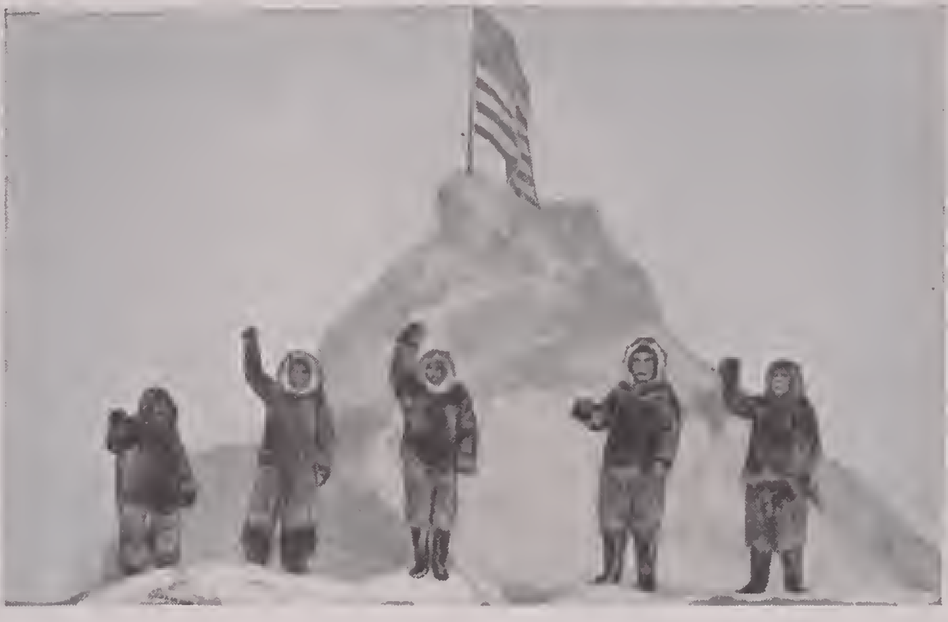
While the North American polar regions were thus being explored, the European and Siberian shores of the Arctic Ocean had also been investigated, at first in the search for a northeast passage and later for

ON THE MARCH TO THE NORTH POLE

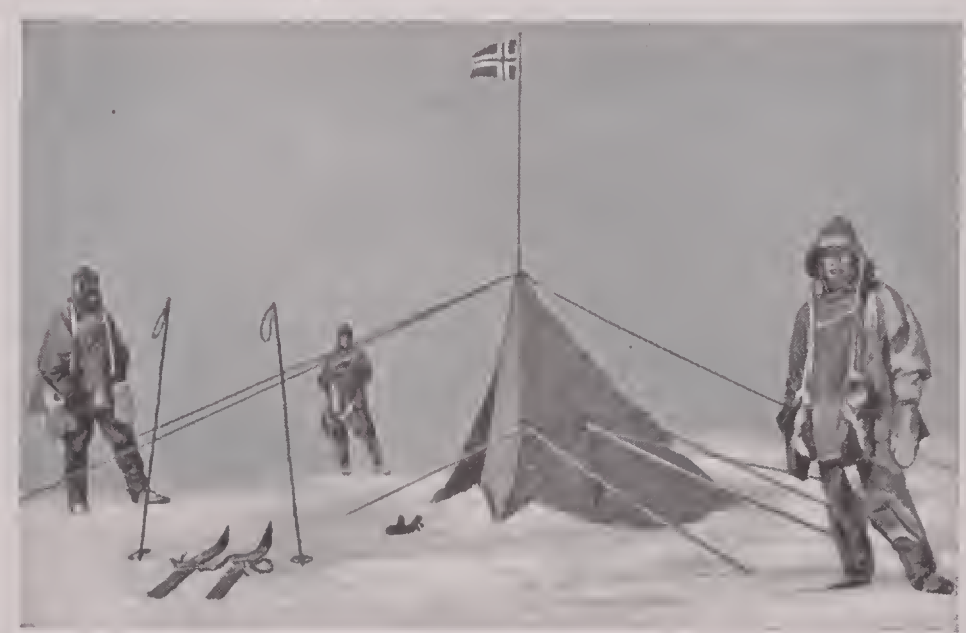
You can see one of the difficulties of traveling over the Arctic ice. Peary's party was often delayed by "leads" or open lanes of water, which broke up the great ice sheet. On one occasion the delay was a full week, before a way across the open water could be found. On other occasions, as shown in this picture, the leads were so narrow that a plank could be thrown across, and the dogs and sleds taken across one by one.

scientific purposes. Spitzbergen, Franz Josef's Land, Nova Zembla, etc., were charted and observations made. Then men began to turn their attentions more and more to the Pole itself. Of the numerous attempts to reach this goal, one of the most interesting was that made by the Norwegian scientist, Fridtjof Nansen.

AT THE ENDS OF THE EARTH—VICTORY AT LAST



On April 7, 1909, Peary, with Matthew Henson, his negro assistant, and four Eskimos, reached the North Pole and hoisted the American flag on a mound of ice. This picture, taken by Peary, shows Henson in the middle.



On December 14, 1911, Amundsen and four comrades reached the South Pole, erecting there this tent surmounted by the flag of Norway. A month later Captain Scott found these tokens before he started on his tragic return trip.

Dr. Nansen had noticed that objects, such as driftwood and a pair of trousers lost from a wrecked steamer, drifted from the coast of Asia across the Arctic Sea and arrived finally in the North Atlantic, between Greenland and Europe. On this and other grounds he decided on a most daring course. He constructed a ship named the *Fram*, making it especially strong to resist crushing by the ice, and shaping it so that the cakes meeting would lift the ship out of water on top of the ice. In this ship in 1893 he allowed himself to be frozen into the ice-pack north of Siberia, with a company of 13 men. For three years they slowly drifted westward. Nansen was quite right in his theories, and they came out just about where he had expected they would, with a real harvest of scientific information and everyone in the best of health. The only disappointment was that they did not drift quite far enough north to touch the Pole itself. Nansen himself, therefore, with one companion left the ship and dashed for the Pole, but was unable to get farther than 86° 14′ N. Four years later an Italian expedition under the Duke of the Abruzzi made a dash across the ice from Franz Josef Land to 86° 34′ N., a little nearer the Pole than Nansen.

Of the many tragic mysteries of the frozen North, one of the most insoluble is the fate of the Swedish aviator, S. A. Andrée, who on July 11, 1897, set forth from Spitzbergen in a frail balloon, with two companions. Five of the 13 buoys carried by the balloon were later picked up, two containing messages. The last word received from the daring aviators was a dispatch tied to the wing of a carrier pigeon, written two days after the ascent. The balloon was then 145 miles north and 45 miles east of the starting point, in latitude 82° 2′, and all was well. What happened afterward or what further messages were sent and never received, we do not know—whether the end came suddenly in some accident of air, ice, or snow, or whether the wrecked aviators slowly perished of hardship and hunger.

But the real hero of north polar exploration is the American naval officer, Robert E. Peary. For 20 years he tried, heading eight expeditions, and was finally rewarded by the victory. His story is told in this work under his name. When Peary arrived in civilization in 1909, after having reached the North Pole, he found the world raging with controversy over the claim of Dr. F. A. Cook that he had reached the Pole a year before Peary. Cook's story was soon generally discredited, and Peary was left as undisputed victor in the quest that had lured men for so many centuries. (*See* Peary, Robert Edwin.)

South Polar Explorations

The Antarctic regions, around the South Pole, were not explored to any extent till after the north polar regions were well charted. The South is farther from the center of European civilization, and the climate there is more severe than in the North. Instead of being, like the North Pole, on a sea surrounded by land, the South Pole is on a vast continent surrounded by sea. It is very difficult to reach this continent because of the Great Ice Barrier which surrounds it, so that the early explorers merely touched here and there, discovering a few small islands outside the polar circle. (*See* Antarctic Continent.)

The work began with Capt. James Cook, who in 1772–75 sailed entirely around this region, but at only two points—in the South Pacific—penetrated the Antarctic Circle. Other men, including the American naval officer Charles Wilkes (1838–42), carried these explorations further, and in 1840–43 Sir James C. Ross discovered Ross Sea and formally took possession of South Victoria Land for the British government.

AN ECLIPSE VIEWED FROM NEAR THE POLE

Captain Scott's party made many valuable observations and obtained data of great scientific value. This is Lieutenant Evans watching the passage of some other heavenly body across the planet Jupiter. Many astronomical phenomena can be best seen from the northern and southern polar regions.

In 1902 Capt. Robert F. Scott, of the British navy, made the first explorations ever made on land in the Antarctic. Starting from South Victoria Land he penetrated some distance into the interior, discovered a chain of mountains, several glaciers, etc., and did much valuable scientific work. Another English naval officer, Lieut. Ernest Shackleton, made a dash for the Pole in 1907–09, starting from near Scott's base, and got within 97 miles of it, but was obliged to turn back. He did, however, locate the south magnetic pole. On a second expedition Captain Scott actually reached the South Pole, Jan. 18, 1912, only to find that Amundsen had been a few days before him. In one of the most tragic and heroic stories of history, Scott and his party perished on the way back to their ship (*see* Scott, Robert Falcon).

The glory of discovering the South Pole falls to Roald Amundsen, a Norwegian explorer who had already won honors in the Arctic. One dark day in December 1905, his dog-sled had dashed into Eagle City, Alaska, having traversed the icy wastes which separated that outpost of civilization from his little ship the *Gjöa*, then frozen in near Boothia

''CASTLE BERG'' AND ITS SHINING TOWERS

This is one of the strangely shaped masses of ice photographed by Captain Scott's Expedition. Like some feudal castle it rises from the frozen Antarctic waters. In the foreground is one of Scott's dog sleds.

YOUNG SEA-ELEPHANTS AND ROYAL PENGUINS

This grotesque assemblage was photographed by Sir Douglas Mawson's expedition on Macquarie Island, which lies about 600 miles south of New Zealand. From this photograph it is easy to see why a colony of Penguins at a distance resembles a crowd of human beings. The Sea-Elephants have come ashore for a nap, but the Penguins are not in the least disturbed by their bulky visitors.

and conducting observations on the north magnetic pole. Returning the way he had come, Captain Amundsen next spring brought his little vessel and total of five companions through the Northwest Passage to the Pacific—the first ship to complete the passage. (*See* Amundsen, Roald.)

The South Pole at Last!

Four years later, in Nansen's ship the *Fram*, Amundsen turned to the Antarctic, which he had already visited as a young man. His expedition went out from Norway in 1910, and wintered at the Bay of Whales, on the opposite side of Ross Sea from where Captain Scott landed. The summer was spent in strenuous sledge expeditions to establish three well-supplied depots on the way to the Pole, and the winter in killing and preparing 132,000 pounds of seal flesh for the dogs and baking 42,000 loaves of hard bread for the men.

The sun reappeared on Aug. 24, and on Sept. 8 Amundsen started over the ice for the Pole. But he found the weather too unsettled and had to turn back again. On Oct. 20 he started once more, with five men, four sledges and 52 dogs, and provisions for four months. On Nov. 17 he reached the Great Ice Barrier and climbed 10,000 feet to the polar plateau, a vast featureless plain that surrounds the Pole. Here he killed most of the dogs. He pushed on, depositing food in depots for the return trip as he went. On Dec. 14, 1911, they reached the spot where their instruments showed the Pole was located. "Quietly, in absolute silence," Captain Amundsen writes, "the mighty plateau lay stretched out before us. No other man had ever yet stood on it. In no direction was a sign to be seen. It was indeed a solemn moment when, each of us grasping the flag pole with one hand, we all hoisted the flag of our country on the geographical South Pole, on 'King Haakon Plateau'."

Here Amundsen stayed for three days, making observations. At the Pole he left records which Scott found about a month later. The return was without mishap with the weather "unusually favorable." Amundsen reached his base on Ross Sea on Jan. 25, and in March the world knew of the deed. The Antarctic equally with the Arctic region had been forced by the indomitable courage and endurance of man to give up its age-long secrets.

AFTER A HARD BLIZZARD

These Penguins are freeing themselves from snow and ice after a storm.

BRAVE GUARDIANS *of* LAW *and* ORDER

A World without Police! You Can Imagine what It was Like and How Crime Ran Riot—Present-Day Systems of England and America—The Famous Texas Rangers and Canada's Mounted Police

POLICE. The modern policeman, who seems so necessary to the life of all big cities, did not exist a hundred years or so ago. It is difficult to understand how people could get along without him, and in fact they did not get along very well. In England until 1829 the only peace officer was the constable, who more or less ineffectually patroled the streets at night at the head of a band of assistants called the "watch." The result was that crime was rampant in London and other parts of England. Bands of drunken roisterers terrorized, maltreated, and robbed citizens with impunity. Highwaymen infested the roads; robbers and burglars carried on their work openly. The watchmen were often corrupt and shared the plunder of thieves. It was estimated that in London at the beginning of the 19th century there was a criminal for every 22 people in the city's population.

THE TERROR OF BAD CANADIANS

The "mounties," as the Royal Northwest Mounted Police are affectionately called by all Canadians, never give up the chase. No corner of the bleak Arctic and no mountain fastness is too remote for them to reach in pursuit of men who have broken the laws of the Dominion.

This condition continued until 1829, when Sir Robert Peel laid the foundation for a better system. It is true that there had been police systems long before that time among the nations of continental Europe, but they were used chiefly as instruments of tyranny. The police (*gendarmes*) of Louis XIV of France, and later of Napoleon, were examples of this. They spent most of their time prying into political secrets and interfering with the private lives of the citizens, paying little attention to the suppression of crime. So when Sir Robert Peel proposed his plan he met with strong objections from liberty-loving Englishmen who feared the French system.

HE ALWAYS GETS HIS MAN!

That is the reputation of the Texas Rangers, the state police force, whose territory includes the wild borderlands of Mexico.

He was able, however, to convince Parliament of the soundness of his scheme, and the foundation of the present British police system was laid. The modern London policeman is nicknamed a "bobby" or a "peeler," after the founder of the system. (*See* Peel, Sir Robert.)

The American police system is not far different from the British, except that the American police are usually under the direct control of the city, village, or county. In England they are government agents, holding their appointments under the king, although they are organized and controlled in most respects by the counties and large boroughs.

In the United States the mayor of the city usually appoints the chief of police, sometimes called the commissioner or superintendent. The chief usually has one or more deputies, who head the various departments. Next in rank are captains, each of whom has a special district of the city under his charge. Some cities have police lieutenants, who work directly under their captains; next are sergeants, detectives, and finally patrolmen.

The three big divisions of the police are the patrol division, the detective division, and the traffic division. The patrolmen are always uniformed men, who walk "beats" and maintain general order. The detectives, who are usually ranked as sergeants, wear ordinary citizens' clothing and are assigned to discovering and running down criminals. This branch of the service has charge of the bureau of identification, where finger-prints are kept of all who are arrested for grave offenses. (*See* Finger-Prints.) The duties of the traffic division are to regulate the passage of traffic on crowded streets and to enforce speed regulations. The division often includes mounted officers.

In the rural districts of America the enforcement of the law is left to town constables and marshals and county sheriffs. The latter are usually elected by the people, and have the power in case of emergencies to appoint as many deputies as they may need to maintain order.

A Terror to the "Bad Man"

Some states have a police force of their own, called a state constabulary. The most famous of these are the Texas Rangers. The Rangers have a long and romantic history, extending back to the days when "bad men" and horse thieves and train bandits ran riot in the West. They have established a reputation of always "getting their man," which perhaps is excelled only by the record of the Royal Northwest Mounted Police of Canada. The latter body of men is probably the most remarkable police organization in the world. From his offices in Ottawa, the commissioner of the Northwest Police directs the maintenance of order in more than 1,200,000 square miles of land and water in what is known as the Northwest Territories. Nearly half of this great wilderness lies inside the Arctic circle. The force consists of only a few hundred men, yet they patrol and maintain order in this huge territory, and when a law-breaker hears the dreaded news that the "mounted police are after him," he usually flees as fast as he can to some other part of the world. Members of this organization have followed criminals as far as India and brought them back to Canada for trial.

In the United States, the militia organizations of the several states are frequently called upon to assist the police in case of serious riots and disorders, and in the case of great disasters, such as big fires and earthquakes.

Our Young Citizens and the Policeman

IF YOU live in even a small village, you probably have a town marshal. He tells boys they must not throw stones or snowballs in the streets, for they might break windows or hit people or frighten horses into running away. He tells them not to build bonfires in the streets, or near fences and barns along alleys. He tells them not to climb shade trees or fruit trees without the owner's permission, for they might break down limbs. He tells them they must not chase cats or tie tin cans to dogs' tails or rob birds' nests or use sling stones on birds. The law forbids cruelty to helpless animals. You see, all these laws are just good common sense and kindness.

Laws are rules for good behavior. You know how much trouble one selfish ill-tempered member can make for a whole family. It is the same in school. One unruly pupil can make trouble for a whole room. One boy who is a "bully" on the playground can spoil everybody's fun. Little law-breakers become big law-breakers when they grow up. Then they find that if they interfere with other people's rights, officers of the law will arrest and punish them. It is better to learn to be good citizens in the home and school, for then it will be easier to obey laws when you grow up.

In small places very few people break laws, because everybody knows everybody else, and a selfish troublesome person soon gets himself disliked and goes away. He is likely to go to a city. He thinks that where there are so many people he will not be noticed, and he can do as he pleases. But there he finds a whole army of policemen whose business it is to keep order. Policemen are the friends and protectors of everyone who behaves well, and the enemies of everyone who makes trouble for others.

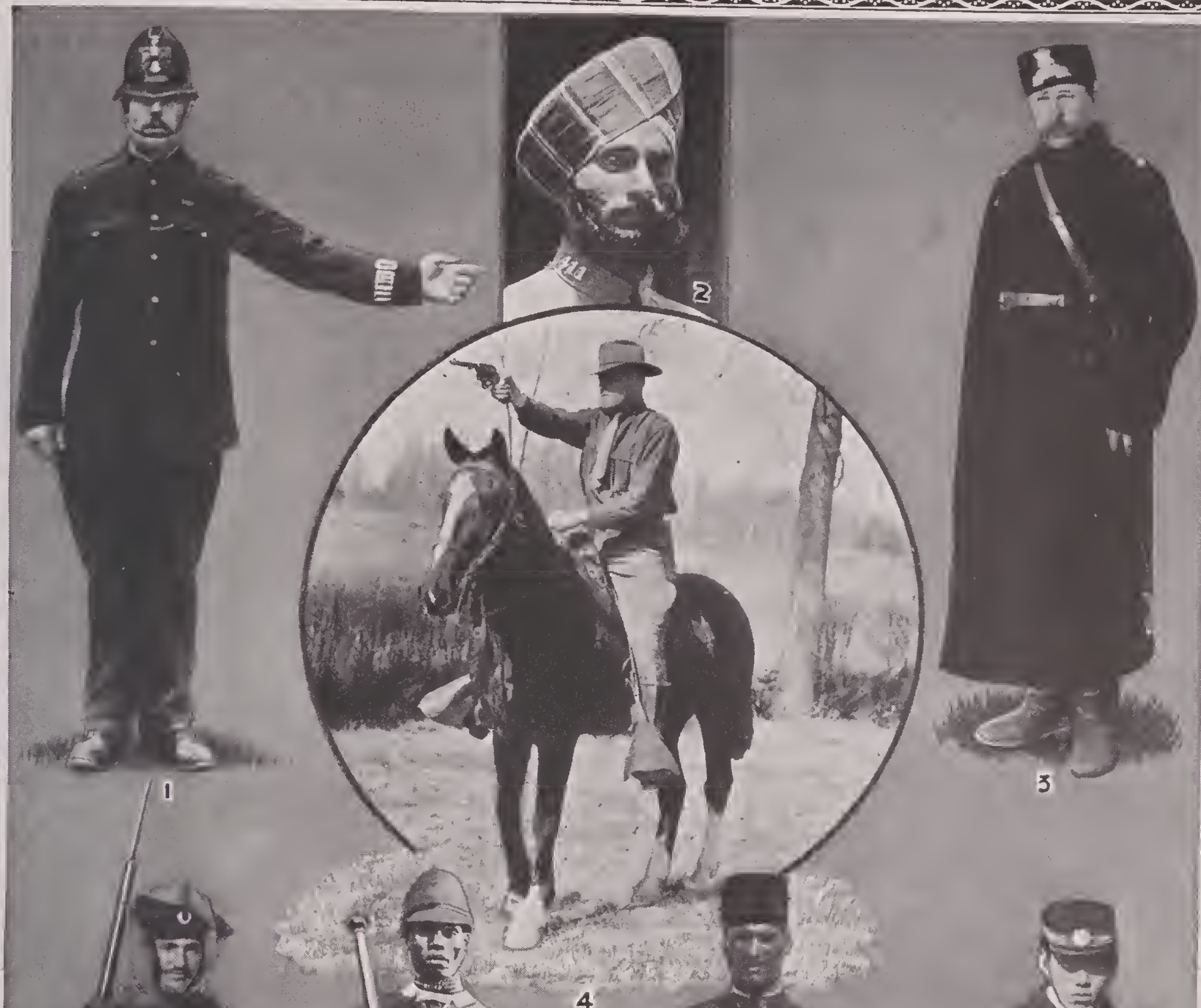
"STOP!"

When the traffic policeman holds up his hand all traffic stops.

Policemen always look out for children. Some schoolhouses in cities are on crowded streets where street-cars, wagons, and automobiles are always passing. Often the children have to cross railroad tracks to get to school. In such dangerous places there is usually a policeman to help the children across. When he lifts his hand, every car or wagon has to stop. Often he picks up a little first-grader who is afraid, and carries her across the street. If a policeman finds a lost child on the street, he calls a police wagon and gives the baby a fine ride to the station house. There he is fed and petted and put to sleep. Then the policeman goes to find the baby's mama and papa. A policeman is the best *strange* friend a little boy and girl can have. You see, he is a peace soldier, and it is his business to take care of people.

Policemen are often in as great danger as firemen. Sometimes they beat the firemen to a fire. If they do, it is their duty to go into the burning house and help get people out. They often stop runaway horses, and snatch people from under horses' hoofs and car wheels. They dive into park lagoons and into rivers to save people from drowning. The most dangerous

THE HAND OF THE LAW IN MANY LANDS



Every corner of the globe now has policemen. Nowhere is the evil-doer safe from the hand of justice, whether he is hiding on the streets of London and New York, in the wilds of central Africa, or the snows of the Yukon. Can you guess from what lands these policemen have come? We will tell you. 1. A London "bobby." 2. Sikh constable in Shanghai. 3. Officer of the old Russian imperial police. 4. Member of the New York State Constabulary. 5. Night policeman in Belgrade, Serbia. 6. One of the Zulus who police the Belgian Congo. 7. Native policeman in Cairo, Egypt. 8. Japanese policeman all equipped for a hard winter.

work policemen have to do is to find and arrest criminals. Many of these men, who live by robbing people and breaking into houses, will kill rather than be captured and sent to prison. But policemen will go right into dark basements and alleys, after men who may be waiting for them with pistols and knives. Plain-clothes policemen, or detectives, are in every big crowd watching for pickpockets; and they are often found in dangerous parts of the city where criminals try to hide. In such sections, often referred to as the "underworld," detectives spend much time, learning the faces and habits of the criminal classes.

THE POLICEMAN AS A BIG BROTHER

He helps women and children across dangerous street crossings. Especially near public schools, the traffic policeman prevents many an accident by his watchfulness and his willingness to risk his own life to protect others.

The crossing policemen are among the tallest and strongest on the force. They stand in the middle of street crossings in the crowded parts of the city, guarding people who are afoot, and keeping the streams of wagons, cars, and automobiles from getting in a tangle. Some policemen are mounted on motorcycles. These are in parks and along boulevards, to stop automobiles that are going too fast. There are special policemen who watch railway stations and boat docks, where visitors who do not know city ways are likely to get into trouble. There are always a great number along the line of processions, and at fairs and celebrations.

The Police Patrolman's Duties

The policeman you know the best is the patrolman. Patrol is a soldier word. It means to walk over and guard a district. A police patrolman has several blocks to watch, and he goes over his district several times a day. At night, another man takes his place. The patrolman has to see that no law is broken, and that everyone is protected. Some night, when you are asleep, there may come a ring at the doorbell. A policeman calls up that he has found a basement window unlocked. He goes through the place to see if a burglar has broken in. No, he says, you were careless and left that window open. Your father thanks the policeman for watching your house so carefully, and that makes you all the more careful afterward.

A policeman must see that people obey the health and street-cleaning laws. He must stop fights and scatter noisy crowds. He must make people keep things off fire escapes. He must arrest anyone whom he finds abusing a child or an animal. He must take care of persons injured on the street, send them home or to a hospital, and arrest the persons responsible for accidents.

Always answer a policeman's questions and obey his orders. He is an officer of the law and he has a right to stop and question people, and he has a right to your help, if he needs it. Policemen usually watch "gangs," for they know that crowds of boys often do selfish and mischievous things. But don't look upon the policeman as an enemy. Be open and above-board, and don't hide or try to play tricks. Active boys can help a patrolman keep order in his district, for they see everything that is going on. In some cities boys have formed law-and-order clubs, and "traffic squads" to help younger children across streets near schools, and have been given badges to wear by the Chief of Police. Districts that have a band of little citizens helping the police are always cleaner and more orderly, and are shunned by sneak thieves and similar offenders. Boys in such clubs have at times won medals for bravery in fires and for protecting animals that were being abused.

There's a lot of fun in being a little law-and-order soldier. Try it and see!

WHAT'S *the* GOOD *of* "POLITICS"?

The Origin and Necessity of Parties in the Governments of Free Peoples

POLITICAL PARTIES. As long as man has had popular government, so long has he had political parties. In the 5th century before Christ the democrats and oligarchs of ancient Athens came to blows for their political principles. In republican Rome patricians and plebians, originally social classes, contended for political power. The city states of medieval Italy rang with contests between the Guelfs, who looked to the pope for leadership, and the Ghibellines, who supported the emperor.

But the political parties of those days possessed none of the elaborate machinery of the parties of today. Only a small number of the inhabitants of those republics participated in the control of the state, and when party feeling rose above a certain temperature, physical force settled the dispute. Modern democracies consist of hundreds of thousands or even millions of voters, and their method of action is that of settling all questions by voting, either by dropping ballots in a box or using a voting machine (*see* Ballot). These absolutely new conditions required new methods, and man was not long in devising them.

England the Mother of Political Parties

As England is the mother of parliaments, so she also first brought forth modern political party government. The roots of this modern institution are to be found in the Cavaliers and Roundheads in the days of Charles I and the Long Parliament; but not until the end of the 17th century do we find organizations such as the political parties of today. At that time there sprang up the Whigs and Tories, the two great parties whose rivalries have shaped the government of England from that day to this. The name "Whig" came from the word "whiggamore," used by the Scots to describe cattle- and horse-thieves; and to call a man a "Tory," at first, was to call him an Irish outlaw.

The Whigs in the early days of the party favored toleration for Protestant dissenters and believed that the king was only an officer of the government, subject to Parliament. Under the leadership of Sir Robert Walpole, the first prime minister of England (1721–1742), it carried out its policy of the supremacy of Parliament by raising the House of Commons to the leading position in the state. The Whig orators, Charles James Fox and Edmund Burke, opposed the tyranny of George III, and in their speeches in Parliament supported the cause of the American colonists in their struggle for independence.

In the second quarter of the 19th century, when the new forces of democracy were struggling with the old system of conservatism, the Whigs, as you might expect, espoused the cause of the people. Amid intense excitement Earl Grey forced through Parliament the great Parliamentary Reform Bill of 1832. Then, in the reforming era which followed, when factory laws, education laws, etc., were passed, the Whigs dropped the old name and adopted the new title of 'Liberals." In the time of Gladstone the party, fully liberalized, stood for freedom of trade, of contract, and of competition, and extension of the suffrage. But when their leader included Home Rule for Ireland in his program, he split the party and the Liberal Unionists came into existence.

But what was the history of the Tories during these centuries? They started out with the belief that the king ruled by "divine right," and that it was sin to resist him. But after George III, aided by the Tory minister, Lord North, had tried to carry out these ideas, as set forth by Lord Bolingbroke in his 'Idea of a Patriot King', and had as a result lost the 13 American colonies, they gave up the idea. Like the Whigs, about 1832, they dropped the name of "Tories" and became known as "Conservatives." Many of them wished to keep things just as they were; but others, while they did not wish to extend political power to the masses, on the other hand did much to relieve the condition of the poor. When Sir Robert Peel repealed the Corn Laws, so the people could buy cheap bread, he split the Conservative party which was largely composed of landlords who profited by high prices of bread. Under Disraeli and the Marquis of Salisbury the Conservative party became the imperialist party of Great Britain. Later the Labor party with a socialistic program became the most aggressive and growing English party, while the Liberal party lost much of its strength owing to dissensions among its leaders.

Spread of the Party System

The party system of England spread not only to America but also to the continent of Europe. In continental countries the people were usually unable to compromise their differences sufficiently to form only two parties. In most of the countries Liberals shaded off from the radical Socialists to reactionary Conservatives, and European parties were frequently known by the position they occupied in the legislative assembly. Viewed from the speaker's platform the Conservative party was found on the right wing and the Liberal one on the left, whence came the names "Right" (Conservatives), "Center" (which shaded into Right Center and Left Center and divided on separate issues), the "Left" (Liberals), and the "Extreme Left" (Radicals and Socialists). Following the widespread revolution produced by the World War, new alignment of parties took place in most European countries.

The English colonists brought to America their old party names, and from 1775 to 1781 the name "Whigs" was given to supporters of the Revolution, and "Tories" to those who remained loyal to England

and the king. With the close of the Revolution these names went out of use, for the question had ceased to be one of the control of king or people and had become one of a strong national government or strong state governments, of loose construction of the Constitution as opposed to strict construction. The Hamiltonian Federalists championed loose construction and a strong central government, against the Jeffersonian Republicans who believed in strict construction and States' Rights. Later, the Whigs took up the cudgels dropped by the expiring Federalists, and the Jeffersonian Republicans evolved into the Jacksonian Democrats, or, as they were later called, Democrats. Not until the close of the Civil War was the ghost of States' Rights finally laid.

Before this occurred, the Whigs had perished and a new political party, the Republican party of today, had been formed. In its beginnings this organization illustrated clearly the principle that should prevail in the formation of a new political party. There must be some great principle upon which all members are in harmony and for which they are ready to forget their minor differences. To prevent the further extension of slavery, Northern Whigs and Anti-Nebraska Democrats overlooked their differences on states' rights, and joined with the Free-Soilers both of Democratic and Whig antecedents.

That the issue upon which the party unites may change from time to time is also illustrated by the Republican and Democratic parties. With the close of the Civil War, and the period of Reconstruction of the South, the old principles of the parties were dead. For a time the main dividing line between the two organizations was the tariff, the Republicans advocating a protective tariff, and the Democrats one for revenue only. Still later new questions of domestic and foreign policy growing out of the World War became party issues.

When a party has built up a strong organization, as have the two old-line parties of the United States, principles cease to play the large part that they did in the early days. Hundreds and thousands of party members then vote for the party candidates regardless of the platform upon which they stand and regardless of the political character of these leaders. "My party, right or wrong," is unfortunately the attitude of too many. That this is not protecting the interests of the country never seems to occur to these party members.

How an American Political Party Works

Just as the Americans when they severed their connection with England dropped the old party names, so in time they also developed a new kind of party machinery. In England the party leaders are all members of Parliament, and they decide upon the party policies. In America practically all voters in the country may now through the direct primaries, share in naming party candidates for office, and take part in the choice of delegates to party conventions that adopt the party platform.

This development has only come about gradually. In the first elections under the Constitution every voter cast his vote for anyone he wished. Naturally this system could not be used very extensively, and so there arose after 1800 a system of legislative and congressional caucus. The Federalist members of Congress would meet in caucus and nominate their candidates for the presidency and the vice-presidency, and the Republicans would do the same. With the growth of the country "King Caucus" met his death, and the system of party conventions developed.

Under the system which finally grew up, delegates to the county and state conventions were picked by a mass-meeting or primary in election districts of the county or in the wards of the city. The county convention nominated county officials and selected delegates to the state convention. This in turn selected candidates for state offices and delegates to the national convention. The national conventions meet usually in June or July before a presidential election, at which the candidates for president and vice-president are selected, and the platform, or statement of principles of the party, is adopted. With the adoption of more direct action by the people, in the 20th century, county, city, and state primaries are to a large extent taking the place of the county and state conventions (*see* Primary Elections) so far as nominations are concerned, with a remnant of the convention system to formulate platforms.

Elaborate Party Machinery

The amazing thing about the American national political party is its elaborate organization, with national, state, county, and ward chairmen and committees, and the strife on party lines, no matter how unimportant the issue. For the sake of maintaining the great national organizations men are nominated and voted upon, as either Republicans or Democrats, for coroner, road commissioner, superintendent of schools, and other offices where their qualifications and duties have nothing to do with their membership in political parties.

Though there are now only two strong political parties in the United States, there are other party organizations. In recent years the Socialists, the Socialist-Labor party, and the Prohibition party have appeared on presidential ballots. The Progressive or "Bull-Moose" party appeared in 1912 under the lead of ex-President Roosevelt as a liberal offshoot of the Republican party, but it ceased to exist after 1916. In North Dakota and surrounding states the Non-Partisan League, an organization of farmers, formed in 1915, gained great strength but worked usually within the lines of one of the old parties. It stood on a broad platform recommending radical changes in political and industrial machinery, notably the state ownership of banks, grain elevators, flour mills, and packing plants; the initiative, referendum and recall; and the short ballot.

Many former party names and nicknames in American political history are now almost forgotten. The

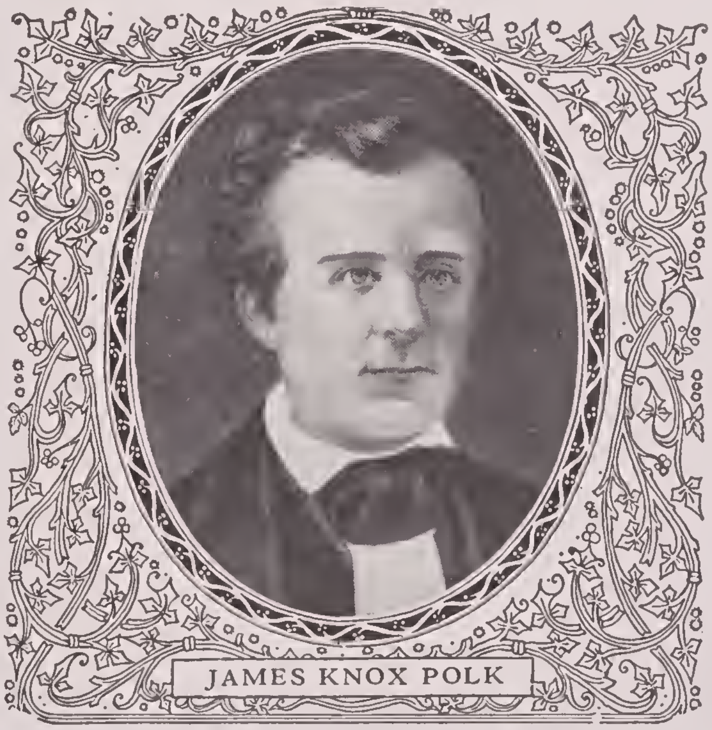
Antifederalists were a political group which opposed the adoption of the United States Constitution in 1787–88 because they feared it endangered the rights of the common people. The Know-Nothings were a secret political society, about 1846–56, whose members wanted only native-born Americans to hold political office. When asked about party secrets they always replied, "I know nothing." Officially their organization was known as "the American party." It had entirely disappeared by 1860.

Slavery caused the formation of the greatest number of political parties. It led to a split in the Democratic party in New York State into the Barnburners and Old Hunkers. Like the Dutchman who "burned his barn to get rid of the rats," the former, it was said, would ruin their party rather than permit slavery in the territories. Then there was the Liberty party or political abolitionists; the Free Soil party, with the campaign cry of "Free Speech, Free Labor, Free Soil, and Free Men"; and finally the Constitutional Union party, of 1860, which wanted to save the Union by more compromises.

Besides slavery, economic questions have led to the formation of political parties. The Loco Focos, or equal-rights branch of the Democratic party, opposed special privileges and the monopoly of the United States bank. It received its name after a meeting in Tammany Hall, in 1835, at which the lights were extinguished to break up the meeting, and the radical element produced "loco-foco" (lucifer) matches—then a novelty—to rekindle the lights. The Greenback party of 1876 favored the continued use of the legal tender paper money issued during the war, and opposed the return to a gold and silver basis. The Populists of the 1890's stood for the unlimited coinage of silver and other radical economic measures. The Knights of Labor was a political labor organization which tried to advance the interests of the workingman, while the Grangers or Patrons of Husbandry did the same for the farmers. Both organizations flourished between 1870 and 1890. The Mugwumps of 1884 were Republicans who were dissatisfied with their own party and supported Grover Cleveland as a "reform" candidate for the presidency.

The PRESIDENT *Who Won the* PACIFIC STATES

POLK, JAMES KNOX (1795–1849). The same Scotch-Irish stock which produced Andrew Jackson, the seventh president of the United States, produced also James K. Polk, the eleventh president; the same state (North Carolina) gave them birth; something of the same frontier conditions environed their youth, and the principles of "Jacksonian Democracy" were also those professed and acted upon by Polk, to whom the United States was to owe its greatest territorial expansion since the purchase of Louisiana by President Jefferson.


JAMES KNOX POLK

Polk's ancestors (then called Pollock) had emigrated from northern Ireland to America early in the 18th century, and his father had been a soldier in the American Revolution. The boy James was born amid primitive farming conditions in Mecklenburg County, N. C., and obtained such education as that frontier district permitted. He entered the University of South Carolina, at Chapel Hill, at the age of 20; and when he was graduated, in 1818, he was acknowledged to be the best student in his class in mathematics and the classics, and for this reason was chosen to deliver the Latin salutatory address. Two years later he was admitted to the bar, and practised law at Columbia, Tennessee.

Polk's ability as an orator was called into use in the political as well as the legal field. He was in great demand at political meetings, and he soon earned the title of "Napoleon of the Stump." During his period of study for the bar he had made the acquaintance of Gen. Andrew Jackson, and this friendship undoubtedly influenced his ideas as well as advanced his fortunes.

Polk's political career began in 1823, when he was chosen a member of the Tennessee legislature. Before his election to the presidency, 21 years later, he had successfully filled the positions of state legislator, had been a representative in Congress for 14 years, filling for four years the difficult post of Speaker of the House when partisan feeling was exceptionally bitter, and had served two years as governor of Tennessee (1839–40). He was recognized as an able Jacksonian Democrat, and was discussed for the vice-presidency in 1840; but in spite of Jackson's influence in his behalf he was defeated for reëlection as governor in 1841 and again in 1843.

In national politics Polk believed that the government had no right to charter a national bank, or to collect more money from the tariff than was needed to pay the expenses of the government; and he declared that anti-slavery agitation was a positive evil. Nevertheless, as presiding officer of the House of Representatives, he was fair to those who differed with him. Even the critical John Quincy Adams, the anti-slavery leader of the House, declared that Speaker Polk rendered him "every kindness and courtesy imaginable" during political debates.

POLK'S ADMINISTRATION
1845–1849
Texas admitted (1845) as a Slave State; Iowa (1846) and Wisconsin (1848) as Free States.
War with Mexico (1846–48).
Wilmot Proviso defeated (1846).
Oregon Question settled by Treaty with Great Britain (1846).
Low Tariff Act passed (1846).
Sewing Machine patented by Elias Howe (1846).
Gold discovered in California (1848).
Territory of Oregon organized (1848).
Free Soil Party formed (1848).

It was not on these questions, important though they were, that Polk was elected president, but on that of the expansion of territory. It was understood, before the Democratic National Convention met at Baltimore in 1844, that Polk was a candidate for the nomination for vice-president. Shortly before the Convention met, ex-President Van Buren issued a statement opposing the annexation of Texas. This lost him the nomination and gave it to Polk, with whom was nominated George M. Dallas of Pennsylvania for vice-president. Polk's platform was summed up as the "Reannexation of Texas and Reoccupation of Oregon," and his determination to thus extend the boundaries both on the southwest and on the northwest brought him the election. The popular campaign cry, especially in the North, was "Fifty-four forty or fight"—thus expressing the determination to take the whole of the Oregon country up to the border of Russian Alaska (54° 40′ north latitude) in spite of the counter claims of Great Britain. Polk and Dallas received 170 electoral votes, to 105 cast for Clay and Frelinghuysen, the Whig candidates.

The question of the annexation of Texas was practically settled on the last day of Tyler's administration, when a joint resolution was passed by Congress providing for its admission into the Union. But the work of carrying out this resolution fell to President Polk, and its logical result was war with Mexico. This came about through a dispute between Texas and Mexico over the boundary between the two. Texas claimed the Rio Grande River as its boundary, while Mexico insisted that it was the Nueces River. President Polk agreed with Texas and sent General Taylor to occupy the territory which was in dispute.

Polk and the Mexican War

The Mexican government naturally resented this. After a clash between the troops of the two countries in the disputed territory, President Polk asked Congress to declare war, on the ground that "American blood had been shed on American soil." The North was not as a whole enthusiastic over the annexation of Texas, feeling that it meant an extension of slavery; and when President Polk asked for the declaration of war, many Northern congressmen criticized the grounds alleged for war. Lincoln, who was then in Congress, introduced a resolution asking that the president point out the spot of "American territory" on which American blood had been shed. In spite of this criticism, Congress supported the Mexican War, which was carried through to a successful conclusion (*see* Mexican War). The result was to add to the United States not only the disputed territory between the Nueces and Rio Grande rivers, but also California, Utah, Nevada, and parts of Arizona and New Mexico—more than 522,000 square miles of new territory—in return for a payment to Mexico of $15,000,000.

This addition of territory raised again in Congress the slavery question. David Wilmot of Pennsylvania moved that, inasmuch as slavery did not exist under Mexican rule, it be specified in the appropriation bill that slavery should not be allowed in any of the territory acquired from Mexico. This "Wilmot Proviso" was not passed, but it brought sharply to the fore the question of the extension of slavery. The discovery of gold in California in 1848, and the subsequent rush of settlers into that region, rendered the question an important one; but it was left for the next administration to attempt to solve it by the Compromise of 1850.

The Trouble over Oregon

The Oregon question was settled without resort to arms. Though the Democrats had declared that they were in favor of taking all of the Oregon country, to which both England and the United States could advance reasonable claims, they accepted England's suggestion to divide the territory along the 49th parallel, England taking the part to the north and United States that to the south of this line. This was a continuation of the northern boundary of the Louisiana Purchase to Puget Sound. President Polk disliked to accept the suggestion because of his campaign promises; on the other hand he did not care to become involved in war with England; so he left the decision to the Senate, which agreed to accept England's suggestion.

President Polk was consistent in his attitude towards the tariff, the bank, and internal improvements. Believing that the farmer, as well as the manufacturer, was "entitled to the nation's protection," he supported the tariff of 1846, which reduced duties so that they approached more nearly a "revenue" basis. He vetoed two river-and-harbor bills providing for internal improvements at the expense of the national government; and he supported the Independent Treasury Act, which ordered that national funds should be kept in the national treasury.

In 1844 Polk had declared that he would not be a candidate for reëlection, and in 1848 he still adhered to that resolution. He was indeed "steadfast to opinions once formed, and not easily moved by popular opinion." He found his greatest happiness in the pleasures of the home circle, rather than in the gay round of public amusements, and looked forward with pleasure to his retirement from public life. But it was a pleasure he enjoyed for only a short time, for he died on June 15, 1849, a little more than three months after he left the White House.

The historian Bancroft, who served in Polk's Cabinet, has left us an estimate of Polk as a "frank and sincere friend, courteous and affable in his demeanor with strangers, generous and benevolent." He adds that "the esteem in which he was held as a man and citizen was quite as high as his official reputation."

POLLINATION. The stamens of a flower are covered with fine yellow grains called pollen. For the production of seeds it is necessary for these pollen grains to be transferred to the pistil, the organ in which the seeds are formed. This transfer is called pollination. Sometimes a flower fertilizes its own seedlets with its own pollen, but more often it is the pollen from a male flower growing upon another plant of the same species, and carried by the wind or by insects, which fertilizes the seedlets. (*See* Flowers.)

POLO. This sport, which has sometimes been described as "hockey on horseback," has been justly called the fastest game in the world; it is also one of the oldest games that we play today. No one knows just how long ago it was played or in what country it originated, but there seems to be no doubt that it came from the East. Twelve hundred years ago the Persians were playing it; and the Chinese maintain that their ancestors took part in polo matches a thousand years before Christ was born.

It is an interesting fact that the wild hillmen of the Himalayas play today a rough-and-tumble horseback game that in many ways is like the polo that you will see at a match on one of the beautiful fields in England or in the United States. More polo is played in India than in any other part of the world. It was brought from that country to England and about 1876 came to the United States.

There are four players on a side, each mounted on a pony that has been trained specially to help its rider. In fact there are many polo ponies that play the game quite as well as their masters do. They follow the ball like a terrier after a rat, and wheel and turn seemingly at the very thought of their masters, who are equipped with mallets to send the ball toward their opponents' goal.

The polo field is a rectangle of turf, 300 yards long and 150 to 200 yards wide, with a goal 8 yards wide at each end marked by posts. The polo stick, which somewhat resembles a croquet mallet, has a long handle and an 8-inch head. Unlike croquet, however, the player hits the polo ball with a full, free swing, and with the flat side, not the end, of the mallet. The ball, which the players try to drive through the goals, is of light wood, painted white. Eight periods of 7½ minutes each make the game, and one point is gained each time a player drives the ball through his opponent's goal.

No game is more thrilling than polo when it is at its best, with eight expert contestants riding like centaurs up and down the field, wheeling and dashing and hitting the ball with almost unbelievable accuracy, and ever trying to send it between the white goal posts.

Water polo resembles basketball more than it does polo, for the members of the teams play "free handed," without any stick or implement in their hands. The game is played either in open water or in an indoor swimming pool. The playing area is usually between 50 and 100 feet long by 20 to 60 feet wide. At either end there is a goal six to ten feet wide, with a cross-bar three feet above the surface of the water. Six or more players make up a team, and the object of the game is to throw an inflated ball, about eight inches in diameter, through the goal beneath the cross-bar. Usually there are four periods of five minutes each.

AN EXCITING MOMENT IN A GREAT GAME

One of the teams in this photograph is American; the other is English. They are playing for the Polo championship of the world. These two nations have brought to its highest development a game played by the ancient Persians at least 2,000 years ago. Horses for the game are now not merely trained, but specially bred, for the game requires an animal with "the power of a hunter, the courage of a racehorse, and the docility of a pony."

POLO, MARCO (about 1254–1324). One day in the year 1295, three bearded and travel-stained men appeared in the Italian city of Venice. They were strange figures among the gayly clad Venetians, for they were dressed in worn garments of curious and outlandish cut. So strange did they look that when they announced that they were Messrs. Nicolo and Maffeo Polo, with Nicolo's son, Marco, and that they were just returned from 20 years' absence in Cathay, even their own kinsmen could hardly believe that these were really the men whom they had thought dead these many years.

The newcomers caused a great feast to be prepared, to which they invited the principal citizens of the town. At the feast they appeared successively in three wonderful changes of silken raiment, each of which when it had been worn for a few moments they ordered cut up and divided among the servants.

While the guests marveled at this, Marco Polo brought out the three soiled coats of quilted cotton which they had worn upon their arrival home. With a sharp knife he cut open the seams, and from these hiding places he poured out handfuls of precious stones—rubies, sapphires, diamonds, and other gems, cut and uncut—of enormous value. This wealth they had acquired at the court of the great Kublai Khan, Emperor of China or Cathay, and they had brought it in this form, knowing that they could not carry so large a sum in gold. The doubting Venetians were thoroughly convinced as to the identity of the travelers, and thereafter the Polos were treated with the respect which they deserved.

The Story of His Adventures

Soon after their return Marco, the youngest, was captured in a sea battle between Venice and Genoa and carried off a captive to the rival city. While in prison there he fell in with a certain Rusticiano of Pisa, a writing man, to whom Marco dictated his adventures. So it happened that we have 'The Book of Ser Marco Polo', one of the strangest and most interesting records of *true* adventures ever written.

The story told in the book is this. Nicolo and Maffeo Polo—Marco was then a baby—went on a trading speculation to the Crimea, and thence, one thing leading to another, on to Bokhara in Turkestan. There they met some envoys from the court of Kublai Khan, the great Mongol emperor who ruled over most of Asia. With these envoys they journeyed to China, which the Khan had conquered in 1267, and were there received with much favor. The Khan had never met any Europeans before and was much interested in what they had to tell him. After a time he determined to send them back to Europe as his envoys to the pope, asking that 100 missionary teachers be sent to instruct his people in Christianity and the arts of Europe.

So the Polo brothers had returned home to Venice in the year 1269, where Nicolo found that his wife was dead and his son Marco 15 years old. After many delays they succeeded in giving Kublai's message to the pope, who was however not able to do much for him. They then set out again for China (1271) taking with them the young Marco.

When they arrived at the court of Peking, the Grand Khan Kublai, who was now an old man but one of great ability, took a great fancy to young Marco, and made him a sort of minister extraordinary, sending him on many journeys throughout all his empire. He learned to speak and read several Asiatic languages, and even visited Tibet and Burma. During these travels Marco collected much interesting information concerning the strange places and people he saw, and it is this information which is written in his book. He also served for three years as governor of the city of Hangchow.

The Famous Trip with the Princess

This time the Polos dwelt in Cathay for about 20 years. Many times they wished to return to Venice, but Kublai Khan would not hear of it. If it had not been for a fortunate chance they might never have returned, and the world would never have heard their story. When at last they were given permission to depart, it was to accompany a young princess who was destined as the bride of the Khan's grandson in Persia. Kublai equipped them magnificently and gave them messages for all the rulers of Europe. Thus, early in 1692, they finally left China.

The trip to Persia was made by sea, and the Polos were the first of Europeans to sail those seas. On account of storms and other mishaps the trip occupied two years. Many of the party died by the way, but the three Polos and the young lady survived. When they arrived at their destination they found that the destined bridegroom was dead, but the lady was married to his son. The Polos then returned to Venice, arriving as has been described. Marco lived to be over 70 years old, and died at home, highly honored by the Venetians.

Marco Polo was thus the first traveler to trace a route across the whole breadth of Asia and to describe Persia, the Mongolian steppes, China and India, Japan and Ceylon, Java and Sumatra, and many other places, as things seen with his own eyes. If these travels of his had been taken at their full value by the Middle Ages, the science of geography would have been very much advanced. But unfortunately they were looked upon by most people rather as fairy tales, though they had their influence, no doubt, in leading Columbus to seek this land of Cathay by sailing westward. It has taken the knowledge gained in later times to show how scrupulously true and how valuable Marco Polo's book really is.

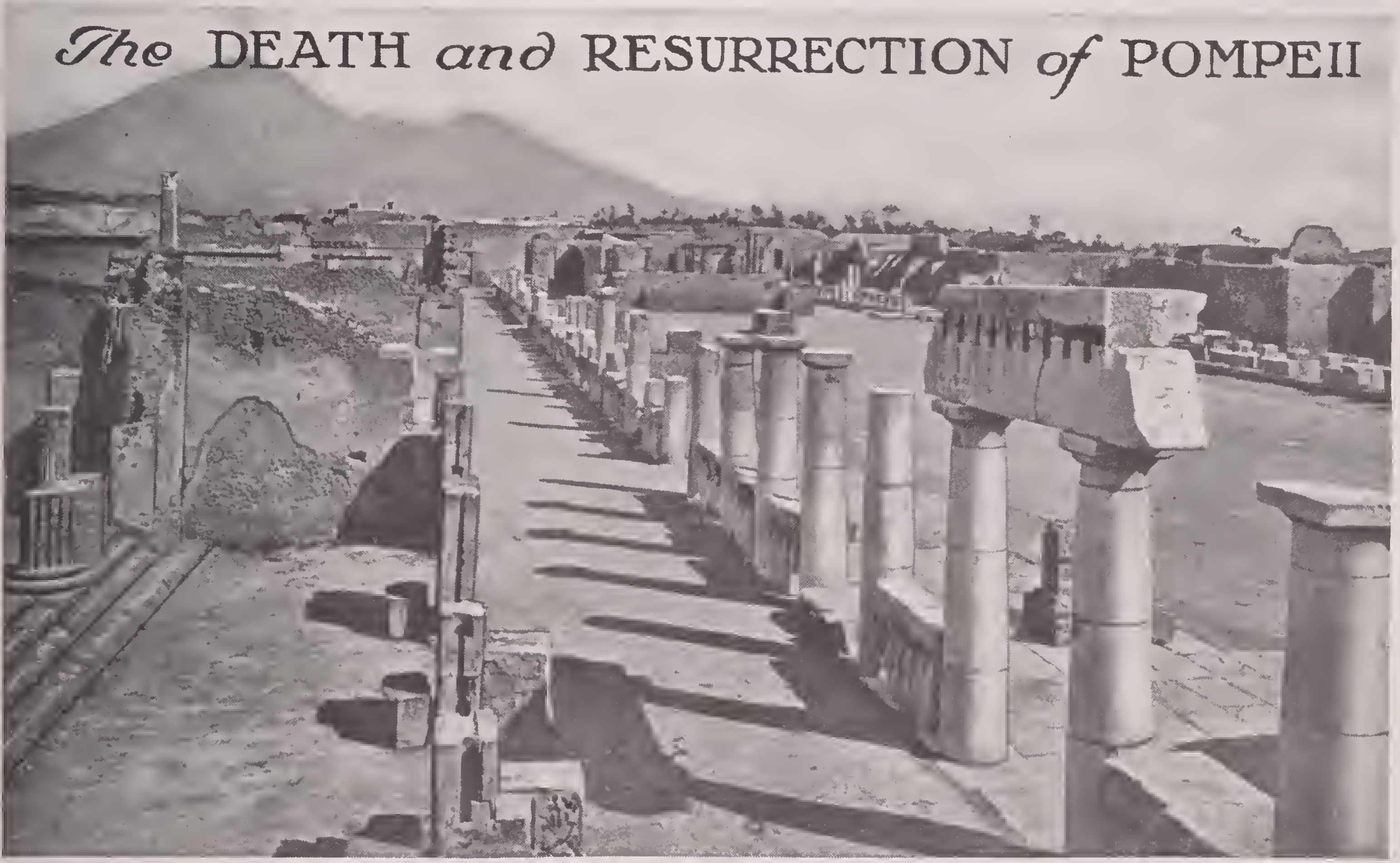
POMEGRANATE (*pŏm'ğrăn-ȧt*). Owing to the fact that the lemon and orange were unknown in early Europe, the acid of this orange-shaped fruit was especially grateful to the ancient Greeks and Romans. From the days of the ancient Assyrians and Egyptians, also, the pomegranate has been a symbol of beauty. Its large brilliant scarlet flowers and its reddish-golden fruit, growing out of the axils of its shining green leaves, have inspired countless allusions in literature and representations in ancient sculpture. The Bible contains many references to it, and in the 'Odyssey' the cultivation of the pomegranate is described in the gardens of the mythical kings of Phaeacia. According to the Greek legend Persephone had to spend six months of each year in the underworld, because she had eaten six seeds of the pomegranate while living with Pluto. (*See* Demeter.)

The pomegranate is little used today as an article of food, for the palatable pulp is merely a coating for the innumerable seeds. It is still in favor in Mexico and Persia, however, in the making of beverages. From the leathery rind of the fruit, from the bark of the tree, and from the root, tannin is extracted for use as an astringent in medicine and in tanning leather.

The pomegranate grows wild in Afghanistan, northwestern India, and southwest of the Caspian Sea, and is widely cultivated throughout the tropics and subtropics. In the United States it is cultivated commercially only in a few Southern states, but is used as a hedge over a wider latitude. The native tree is small and bushlike, with opposite or alternate lance-shaped leaves. Under cultivation it reaches a height of between 15 and 25 feet.

Scientific name, *Punica granatum* (*Punicus* meaning Carthaginian, because it was imported by the Romans from Carthage). Some botanists ally it to the myrtles; others place it in a separate order *Punicaceae.*

The DEATH *and* RESURRECTION *of* POMPEII



A View of the Ruins of Pompeii, after the Ashes and Soil of Centuries Had Been Removed

POMPEII (*pŏm-pā'yē*), ITALY. For 600 years the ancient city of Pompeii had nestled on its plateau of ancient lava, on the Bay of Naples, less than a mile from the foot of Mount Vesuvius. It carried on a prosperous trade in wine and oil, and many wealthy Romans had built villas there, lured by its blue skies and the glamor of Greek elegance it had kept from early times. Within the memory of man the mountain had always been friendly and the lava poured out in ancient eruptions made a good soil for grapes and furnished stone for pavements and buildings.

Then, on the morning of August 24, in the year 79 A.D., the giant volcano suddenly awoke from its centuries of slumber and began belching forth a great column of cinders, pumice stone, and ashes. A dense black cloud shot up to an enormous height and overspread the heavens. It blew rapidly toward Pompeii, shrouding the city in darkness, broken only by lightning flashes, and there descended upon the doomed city a hail of pumice and volcanic ash. For three days the terrible rain of fire continued. Most of the population escaped, but some of those who sought to flee in boats had those sink beneath them under the weight of the ash. Others who sought refuge in cellars were suffocated by the stifling sulphur fumes or crushed under falling roofs. About 2,000 persons perished out of a population of 20,000. At each of the eight gates, the sentries, true to the stern Roman ideal of duty, died at their posts, and there their remains have been found embedded in the ash. When the darkness lifted on the third day Pompeii lay buried under eight to ten feet of pumice, and six

A POMPEIAN MATRON SPENDS AN AFTERNOON AT HOME

The Pompeians did not overwork themselves, as you might guess from this painting. Not all Pompeian mothers, of course, could afford to have slaves swing them all the afternoon, while their children played around them. But luxury was the prevailing note, for Pompeii was a favorite resort for wealthy Romans.

or seven feet of volcanic ash. So great was the alteration of the seacoast that the site now lies nearly two miles inland.

Under this blanket of death the city remained buried and gradually forgotten for nearly 1,700 years. In 1748 a peasant came across traces of it beneath his vineyards. Since then the city has been gradually dug out, bit by bit, until now its ruins tell us the story of Roman everyday life as it is told nowhere else. Here you may walk between rows of shops and houses, along street after street with the marks of the horses' hoofs and the ruts worn by chariot wheels in the paving blocks. You may also read on the walls the scribblings of schoolboys, announcements of shops to rent or gladiatorial contests, and election notices scrawled in flaming red letters.

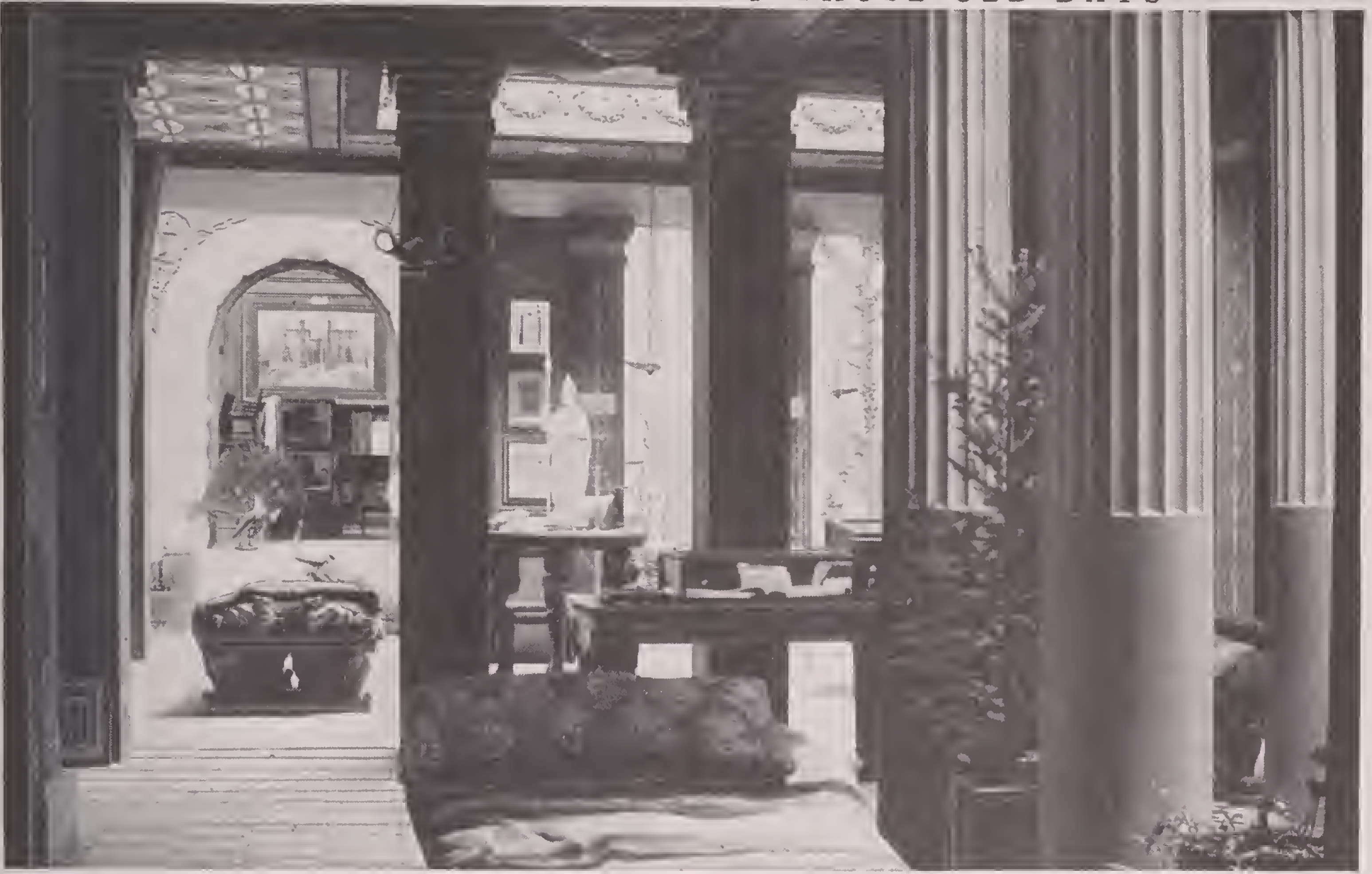
Public life as shown by excavations centered in the forum or market place, where temples elbow business houses and offices. In the market stalls edging the forum were found charred nuts, fruits, and loaves of bread, left by the dealers in their flight; and a wall painting shows how peddlers of kitchen utensils and shoemakers used to ply their trades in the forum itself.

A short distance from the forum is a cluster of temples, and with them a great open-air theater. Not far away is a smaller roofed theater, the *palaestra*, where young men wrestled and threw the discus, and the barracks of the gladiators. Here were found greaves and helmets and gladiatorial swords. Three public baths lie convenient to the forum and the palaestra. These are so well preserved as to show the way great furnaces were used to heat the water and supply hot-air heat for the rooms, and how the bather proceeded from a warming room to a hot room, then to a cold room, and outdoors again.

Home Life in Pompeii

Of private life in ancient Pompeii the story is equally complete. The houses show a blank wall to the street, as oriental houses and many in southern Europe still do. Once you enter the vestibule you see that the occupants got their air and sunlight from a central court or a back garden. Opening out of the great room or *atrium* are the bedrooms—hardly more than cupboards—the store room, dining room, and kitchen. In the kitchen is a raised hearth, on top of which burned the charcoal fire for cooking; in houses where there was a bath this hearth was made to provide heat for that as well. A water system brought water for the bath and sometimes for a fountain in the atrium as well. The only thing you miss is furniture, for of course the wooden beds and chairs

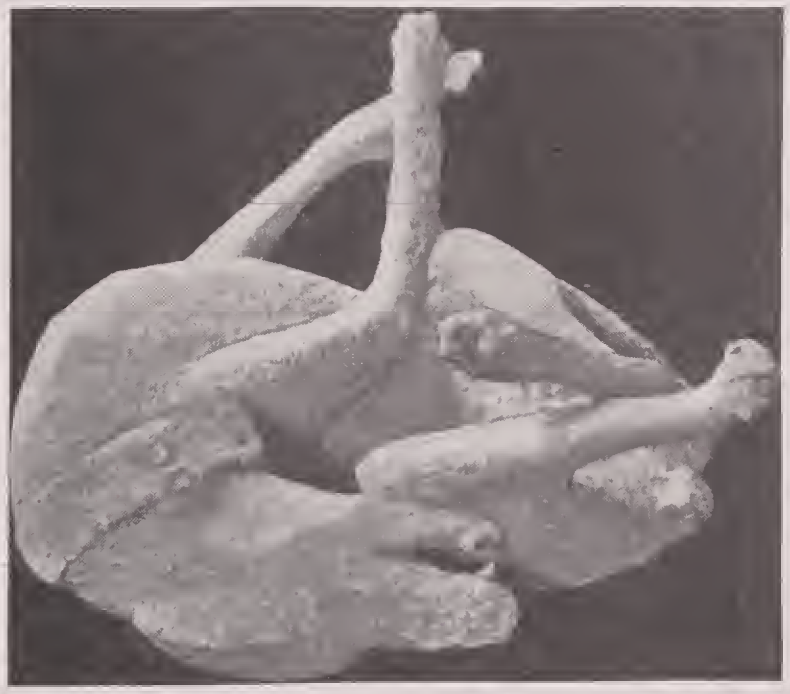
THE CHEERFUL HOMES OF THOSE OLD DAYS



This is a reconstruction of a house found among the ruins of Pompeii—the house of Pansa, it is called. Although it was the home of a Roman gentleman when the ashes of Vesuvius buried it in 79 A. D., it is one of the best examples we have of a Greek house, for the Romans borrowed their plans from the Greeks, and made only a few changes in style, such as the rounded arch of the doorway.

and dining couches were all burned or have since crumbled away, leaving only the wall paintings and the mosaic floors as decorations for the interiors.

We see also in this uncovered city how people worked as well as how they lived. Outside the bakeries are the great millstones which ground the grain and inside you will sometimes find kneading apparatus. A potter's workshop has two ovens; the dyehouses are provided with large lead kettles, and in a closet were found bottles containing colors; the tannery has vats and tools of bronze and iron. There are inns and wineshops, with utensils for heating food and drink and great stone jars set in the counter for storing them. One or two street signs remain, in terra cotta relief, and the books of an auctioneer's establishment were found—waxed tablets with receipts scratched on them.



The ashes that buried Pompeii formed a sort of plaster mold which preserved the outlines of this dog's body, centuries after the body itself had moldered into dust.

Many thousands of smaller objects found in Pompeii have been taken to the museum at Naples, 13 miles away, for safekeeping. There you may see paintings, statues, mirrors, coins, pens and ink bottles, and even the very food that some of the Pompeians were having for lunch on the day of the eruption, and the pans it was cooked in. In the smaller museum at Pompeii are death casts of some of the people themselves, for the ash that buried them formed a sort of plaster mold which has preserved the outline of their bodies.

A few miles nearer Vesuvius lies Herculaneum, another Roman city buried in the same eruption. Excavation is much more difficult here, since the city is covered by 30 to 120 feet of hard rocklike lava, but tunnels have been sunk to the great theater, the forum, and some temples and private houses. Though the ruins are much less accessible and interesting to visit than those of Pompeii, the art treasures unearthed—statues in marble and bronze, and paintings—are far more valuable. The most remarkable discovery was that of 1,800 rolls of papyrus manuscript, charred almost to cinder; but hundreds of these manuscripts have been unrolled and deciphered.

POM'PEY THE GREAT (106–48 B.C.). In the stormy times that marked the close of the Roman republic, Gnaeus Pompeius, who was born in the same year as the orator Cicero and six years before the illustrious Julius Caesar, was one of the most celebrated of Rome's military leaders. In the civil war between Marius and Sulla he won such a brilliant victory over the Marian armies, in Africa and Sicily, that on his return to Rome he received the title *Magnus*, or "The Great." After a successful campaign in Spain he was elected consul for the year 70 B.C., and although he was under the legal age, and had held none of the lower offices, the Senate reluctantly removed these disabilities by a special act. He espoused the people's cause, and repealed many of the hated laws of the aristocrat Sulla, passed after his victory over the followers of Marius.

After the close of Pompey's consulship he was given supreme command in the Mediterranean and for 50 miles back from its shores—an unheard-of power. He rid the Mediterranean of the pirates who had long infested it; he subdued Mithradates, ruler of the kingdom of Pontus on the shores of the Black Sea, and Tigranes, king of Armenia; and captured Jerusalem and made Syria a Roman province. When he returned to Rome for his third and most splendid "triumph," he was looked upon as a second Alexander.

This triumph marked the turning point in his career, for in political affairs he proved less able than in military. An alliance, known as the first triumvirate, was formed between Pompey, Crassus, and Julius Caesar, and Caesar gave his daughter Julia in marriage to Pompey. But after her death, and that of Crassus, the bond between Caesar and Pompey was loosened, and jealousies arose. While Caesar was ruling the province of Gaul as proconsul and gaining great prestige, Pompey remained at Rome, where he gradually lost influence.

Fearful of Caesar's power, he now returned to the Senate party. The inevitable conflict came when Caesar, refusing to disband his army at the command of the Senate, crossed the Rubicon and marched to Rome. This civil war ended with a complete victory for Caesar at the battle of Pharsalus, in Thessaly, in 48 B.C. Pompey fled to Egypt, where he was treacherously murdered.

PONCE DE LEON (*pōn'thā dā lā'ōn*), **JUAN** (about 1460–1521). It was an old legend that made a discoverer out of this Spanish soldier of fortune. Perhaps while he was accompanying Columbus on his second voyage (1493), perhaps later while governor of Porto Rico, Ponce de Leon heard from the Indians of a mysterious island called Bimini. In this was a wonderful healing spring, which, in the Spaniard's mind, must be the Fountain of Youth of ancient tales, capable of making old men young who bathed in it. So in 1513 Ponce de Leon sailed in search of Bimini, and on Easter Sunday of that year landed not far from the mouth of the St. John's River—the first white man to touch Florida's soil. He explored the coast southward to the tip of the peninsula, and then the west coast northward to Pensacola Bay, after which he returned to Porto Rico. Ponce de Leon did not revisit Florida (which he still believed to be an island) until 1521, and then an attack of savages forced him to retreat, after landing, with a fatal arrow wound. (*See* Florida.)

POOR-LAWS. The duty of providing for the poor has been recognized by all civilized nations. Athens boasted of having no citizen in want, "nor did any disgrace the nation by begging." But her wars finally brought poverty, and the state decreed that those who were wounded in battle and the widows and children of those who fell should be supported at the public expense. There were also societies for the relief of distress among some of the Grecian states.

Among the Romans the free distribution of grain to the poorer classes was introduced by Gaius Gracchus, and continued till the fall of the empire. In the time of Augustus 200,000 people were thus fed. Cicero mentions this provision of the Roman law as one in high favor with the people, since it furnished them abundant food without labor. Other Roman writers describe its results as injurious, because it created a race of idlers and left the soil uncultivated.

The obligation of alms-giving as a religious duty reached its highest development under Christian teachings. In the Middle Ages the church was the great receiver and dispenser of alms, and the rich monasteries and abbeys distributed doles to the poor. In most states of continental Europe the church remains to a greater or lesser extent the source of relief to the poor, the state only stepping in when the contributions of the church and of private charity are insufficient.

In England a statute of 1388 is the first law that makes provision for its helpless poor. Various statutes were passed after that time, culminating in the Elizabethan statute of 1601, which has formed the basis of the poor-law system of England to the present time. This ordered that each parish levy a rate or tax for the relief of the helpless poor of that parish, and directed the justices in every county to appoint three or four well-to-do householders in each parish to be overseers of the poor in connection with the churchwardens. Workhouses were also provided in which the able-bodied poor could be employed at useful labor, and severe penalties were provided for "sturdy beggars."

Various efforts were made to remedy abuses which arose under this system, in the course of the wars with the French Revolution. In 1834 there was passed the great poor-law reform act, which among other things established a central governmental board to oversee the whole system of poor relief. The fundamental rule in England and Wales is that each parish is bound to maintain its own "paupers," and this is done by a "poor-rate" which churchwardens and overseers may levy on all persons occupying land in the parish.

In the United States a system of poor relief somewhat similar to that of England prevails in most of the states. Poor-houses are established by the county to which persons unable to support themselves are transferred and cared for, such work as they are able to do being provided for them. In some states provision has been made for children's homes, where all children under a certain age, whose parents are dead or unable to provide for them, are fed, clothed, and educated. Happily thus far the number of dependent persons in America is so small that the tax for their support is not seriously felt.

POPE, ALEXANDER (1688–1744). Few men have triumphed over greater handicaps than did Pope, who became the foremost poet of his day. He was sickly and had a deformed spine; and the intolerance of that day closed the better schools to him because he was a Roman Catholic. But from his earliest youth, according to his own words, verse came to him with little effort. He said that as a child he "lisped in numbers for the numbers came." The "numbers" took the form of the heroic couplet, which was then the prevailing verse form. The following is an example:

> Know then thyself, presume not God to scan;
> The proper study of mankind is man.

The first long poem which Pope published was the 'Essay on Criticism'. In it he expressed the common-sense ideas of his time on art in literature, in the most compact and highly polished form yet seen in English. The 'Essay on Criticism' made a name for him in 1711, the year of its publication. In 1712 appeared 'The Rape of the Lock', which tells in mock heroic style of the theft of a lock of hair from a belle of his own day. Pope added sarcasm to his verse in such lines as:

> Not louder shrieks to pitying Heav'n are cast,
> When husbands or when lap-dogs breathe their last.

By this time Pope was famous. He was known to all literary men of London and formed friendships with many of them. Swift the satirist and Lord Bolingbroke the statesman were his favorites. During the ten years following he was busy with his translation of Homer into English verse; this is still the most popular and most generally read translation, though its style, in the words of Matthew Arnold, is "entirely alien to the plain naturalness of Homer's manner."

Crooked and dwarfed in body, Pope was also crooked and dwarfed in spirit. In 'The Dunciad' he heaped ridicule and abuse upon his enemies and critics in a manner wholly disgusting to modern taste. He excused himself on the plea that less vigor would have no effect. In his own words he says:

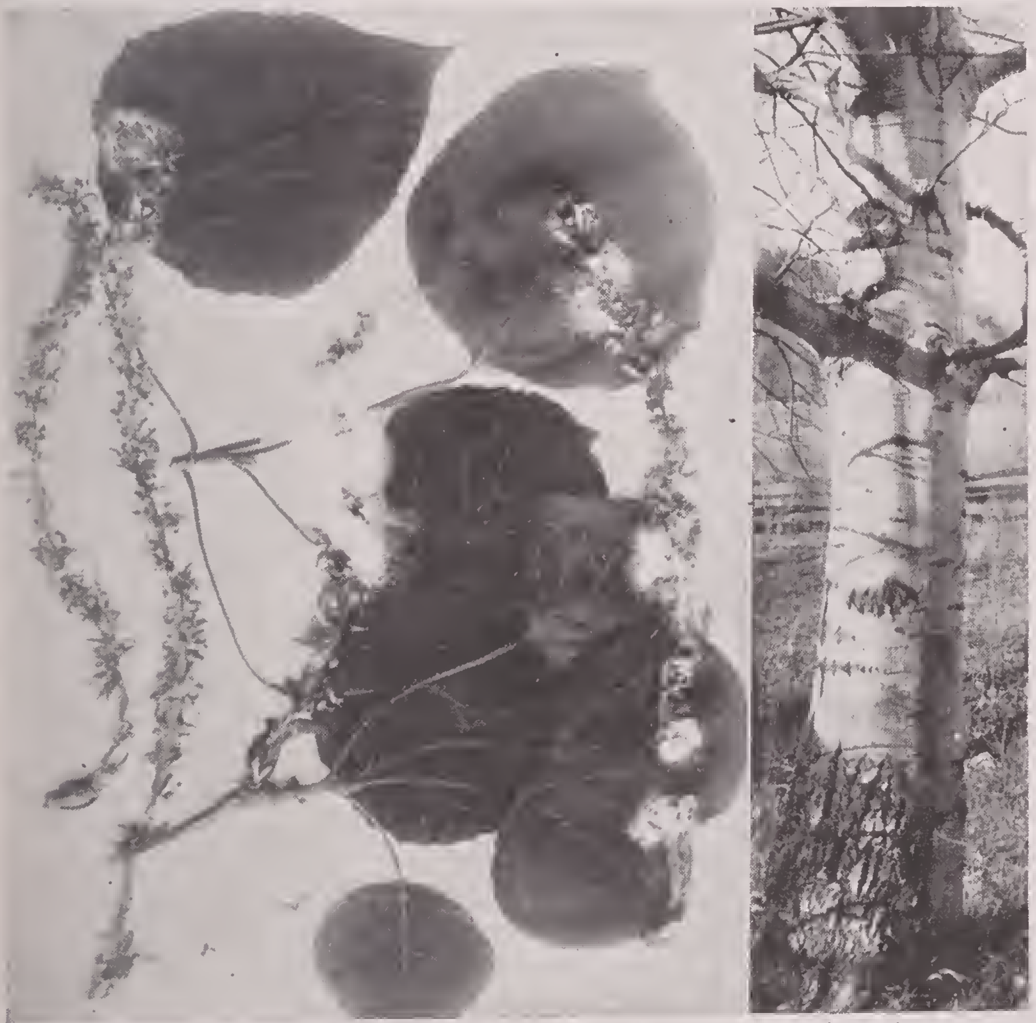
> You think this cruel? Take it for a rule,
> No creature smarts so little as a fool.

All Pope's work shows his mastery of epigram, of tightly packed wisdom; but his 'Essay on Man' is more quoted than any other, partly because quotable couplets occur in greater profusion in it, and partly because it is the best expression of the philosophy of life which prevailed so widely in Pope's day: "Whatever is, is right." Today no one ranks Pope as a great poet, but he is assured the immortality that comes to one who can make commonplaces quotable in a form half poetic, half philosophic.

Pope's chief works are: 'Essay on Criticism' (1711); 'Rape of the Lock' (1712); The 'Iliad', The 'Odyssey', 'The Dunciad' (1728); 'Essay on Man' (1734).

POPLAR. There are about 25 species of this tree native to the Northern Hemisphere, about half

THE TREMBLING POPLAR OR "QUAKING ASP"



All varieties of Poplar grow very rapidly, and are valuable for shade and ornament years before the slower-growing hardwood trees have become useful. Here we see the bark, leaves, and "catkins" of the Trembling Poplar.

of them belonging to North America. They may be divided into two groups, the balsam poplars, having sticky buds, and the white poplars and so-called "aspens," whose buds are not coated with resin. Clothed in trim garments of fluttering shimmering silver and green leaves, among which are hidden fluffy drooping catkins, the common poplar or cottonwood (*Populus deltoides*) abounds along the roadsides and in the fields. The leaves appear early in the spring and in the first part of June the tiny seeds begin to fall from the feathery catkins, covering the ground with the soft delicate cotton in which they are inclosed. Through the summer the abundant heart-shaped foliage casts a cooling shade. The tree is highly valued for ornamental purposes, but the wood is soft and is of little value excepting for paper pulp. The aspen types with tremulous foliage include a few "weeping" forms which are exceptionally beautiful, casting a cooling shade and enhancing the charm of any garden. Poplar lumber is valuable, but it warps badly in drying.

The Lombardy poplar, one of the European species, is beautiful to look upon, being straight and tall with slender skyward-pointing limbs, but it is of little value commercially or as a shade tree. It is native to Italy and France, but is now common in the eastern United States.

The great tulip tree (*Liriodendron tulipifera*), which is one of the finest American forest trees, is not a true poplar, though often called the "tulip poplar."

POPPY. What the tulip is to early spring, the poppy is to midsummer—a gorgeous riot of color flaming in our gardens, with blossoms equaling in beauty and variety of form those of its earlier blooming rival. Its nodding buds, the dainty poise of the opened flowers, and the silken texture of its brilliant petals make it one of our loveliest blossoms. In addition to the single kinds—ranging through an infinite variety of color, from pure white, pink, and rose, to yellow, orange, and scarlet—there are the plumelike carnation-flowered poppies with fringed petals, and the double peony-flowered varieties with plain rounding petals which rival their namesake in size and gorgeousness of coloring.

These garden varieties of the poppy have all been obtained by selection and cross-breeding from different wild varieties, of which perhaps the ancestor of the opium poppy (*Papaver somniferum*) is the chief. The latter is probably a native of southern Europe and western Asia, but in Persia, India, and China it has been extensively cultivated to produce the opium of commerce. Its milky juice, thickening and darkening as it issues from shallow cuts made in the young capsules, furnishes the crude opium (*see* Opium). The seeds yield oil used in making paint and cheaper grades of salad oil.

The common scarlet or corn poppy (*Papaver rhaeas*) which grows wild in the wheat fields of Great Britain and the European continent, is another parent of the garden varieties. This is the poppy so often mentioned in English literature. Ruskin describes it as "all silk and flame, a scarlet cup seen among the wild grass, far away like a burning coal fallen from Heaven's altars." In the World War this European poppy took on a more poignant significance, for—

> In Flanders' fields, the poppies grow
> Between the crosses, row on row,
> That mark our place; and in the sky
> The larks, still bravely singing, fly,
> Scarce heard amid the guns below.
>
> We are the dead. Short days ago
> We lived, felt dawn, saw sunset glow,
> Loved and were loved; and now we lie
> In Flanders' fields.

The little yellow poppy which grows wild through the Middle West of America belongs to a different family, being related to the bloodroot. Of still another family is the yellow California poppy (*Eschscholtzia californica*) from which Luther Burbank has developed with his wizard skill beautiful cultivated varieties of many shades.

POPULATION. Man has inhabited the earth tens of thousands of years; but he has increased more in numbers since 1800 than in all the uncounted centuries since our race first appeared. In 1800 it was estimated that the total population of the world was only about 700,000,000; while today a billion has been added to that number, giving a total of about 1,700,000,000, and the increase still continues.

The primary cause of this increase is the advance in science in the last century. Improved agriculture and stock-breeding have increased the world's food supply; and the use of steam power has multiplied a hundred fold the product of man's hands in the way of manufactures. Railroads have opened up new countries, with their tremendous agricultural possibilities, and steamships have reduced to a few cents the cost of carrying a workingman's daily food to Europe, Australia, or America. Science has largely conquered epidemic disease, and the progress of civilization has reduced tribal war. The annual death rate in the British Isles, for example, fell in 50 years from 23.7 per thousand of the population to 17.5—a decrease of almost one-fourth. Thus more people live to old age than formerly, and the average limits of life itself have been extended.

Naturally the increase of population has been greatest in the western world where science chiefly flourishes; but there are still as many people in Asia as on all the rest of the earth together. Europe possesses one-fourth, and the remaining fourth is divided among North and South America, Africa, and the islands of the Pacific. Contrary to the general belief, however, Europe has on the average twice as many people to the square mile as has Asia. England, with an average of 624 to the square mile, is almost as crowded as Java, the most thickly settled land of the Orient. But we must remember that England's population is chiefly industrial and derives its food largely from other countries, while Java is almost entirely self-supporting, as is the rest of Asia.

The white race forms only about one-third of the world's population—550,000,000. Against this is to be set the 1,150,000,000 of the "colored" races, distributed as follows: the yellow race, chiefly in eastern Asia, 500,000,000; the brown peoples of southern Asia and northern Africa, 450,000,000; the blacks, chiefly in Africa, 150,000,000; and the red Indians, mostly south of the Rio Grande River, 40,000,000. It is also calculated that under normal conditions it takes 80 years for a white population to double its numbers, 60 years for the yellow and brown peoples, and only 40 years for the blacks.

Figures for Europe and other lands where birth statistics are accurately kept show that there are more boys born than girls, the excess ranging from 20 to 60 more boys in every 1,000 births. But more boy babies die than girls, and men are more exposed to death from industrial accidents, war, and other causes than women; so that in most highly civilized countries the women come to outnumber the men. Even before the World War there were more women than men in Europe, owing partly to the fact that men tend to emigrate more than do women. America and Australia, which receive Europe's overflow, show a larger proportion of men. In Asiatic and African countries, where the conditions of women's life are harder, their death rate is higher and men apparently outnumber the women. For the world as a whole there are slightly more men than women, although with the white race alone the proportion is reversed.

How Many Can Read?

The highest percentage of illiteracy is in India, where nine-tenths of the people cannot read or write. In the Balkan countries, Spain and Portugal, Russia, and most of Central and South America, more than half of the people are illiterate. The smallest percentage of uneducated people is found in Germany, where it is only one-tenth of 1 per cent, and in Switzerland, where it is three-tenths of 1 per cent. Due to the large proportion of negroes and uneducated immigrants in the United States, its average is rather high—7.7 per cent.

The DAINTIEST CREATIONS *of the* POTTER'S ART

Story of Porcelain and China's Preëminent Skill in Its Manufacture—Legends of Magic Powers Inspired by Its Beauty—Artistic Wares of Other Countries

PORCELAIN AND CHINAWARE. One of the forgotten geniuses of antiquity is the unknown Chinese potter who first melted powdered rock with clay to form that wonderful hard white translucent substance that we call porcelain. To speak of porcelain is to speak of China—in fact, the word "china" or "chinaware" is a synonym for porcelain; for in that country the art of porcelain-making was brought to such perfection that it is still the despair of modern craftsmen.

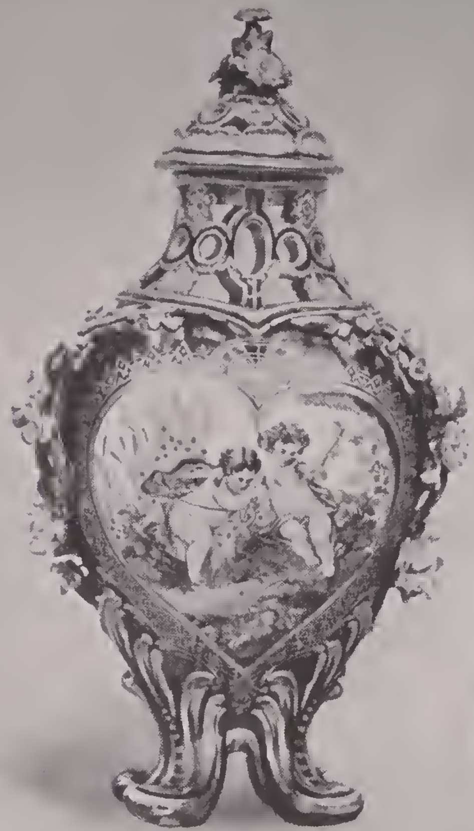
At every turn romance clings to the history of this daintiest of the potter's creations. As early as the first half of the 9th century of our era the poet Tu of China wrote: "The porcelain of the Ta-yi kilns is light and yet strong. It rings with a low jade note and is famed throughout the city. Your Excellency's white bowls surpass hoar-frost and snow. Be gracious to me and send some to my poor mat-shed." And a century later, when the art of coloring this delicate ware had progressed, the porcelain of the province of Honan is described as "blue as the sky after rain, when seen between the clouds, as clear as a mirror, as thin as paper, and as resonant as jade."

A Chinese vase, made about 1500 A. D., with elaborate handles in a chrysanthemum pattern.

The beautiful and elaborately decorated ware of China first found its way to the west when the great Saladin sent 40 pieces to the Sultan of Damascus in 1171. From that day to this, porcelain has been the pride and delight of kings and princes and men of wealth, and especially perfect and ancient specimens have been sold at prodigious prices. Wonderful legends long survived of its origin and mystical powers. For many centuries the credulous folk of the Middle Ages believed that a cup of porcelain changed color and flew into pieces when a poisonous draft was poured into it. To this day the Dyak of Borneo treasures with sacred regard vessels of ancient Chinese porcelain, which his people believe to be made of remnants of the same clay from which the sun and moon were made, and to have miraculous powers of curing diseases and repelling evil spirits. The finest specimens of the ancient art are today in royal palaces and museums, and held in such priceless estimation that no offer would buy them. For one small ginger-jar collectors have paid as high as $30,000.

The composition and manufacture of porcelain were guarded as secrets by the Chinese for many centuries. Not until the beginning of the 18th century did European potters discover the art of making anything resembling the fine Chinese porcelain, and

RARE AND VALUABLE SPECIMENS OF FINE PORCELAIN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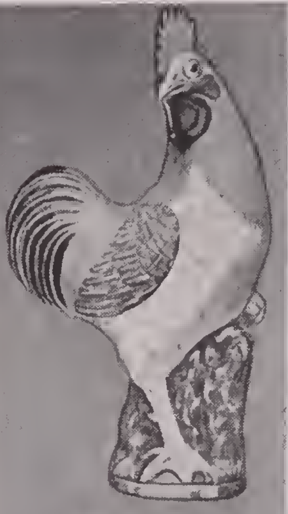
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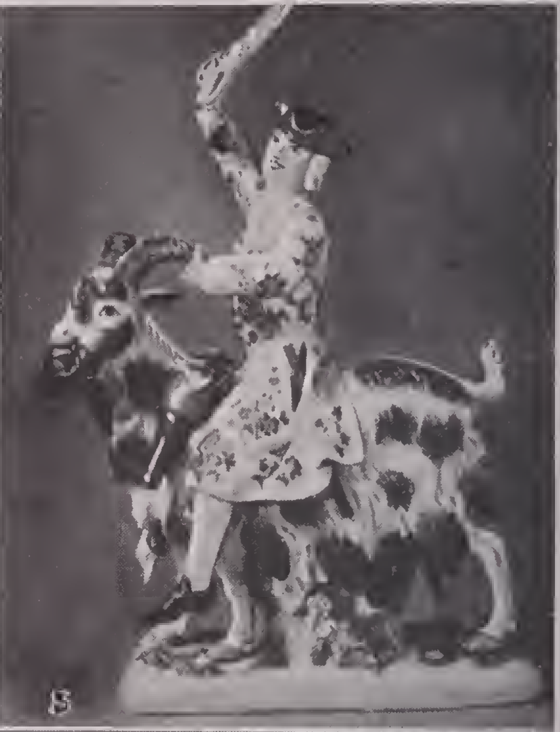
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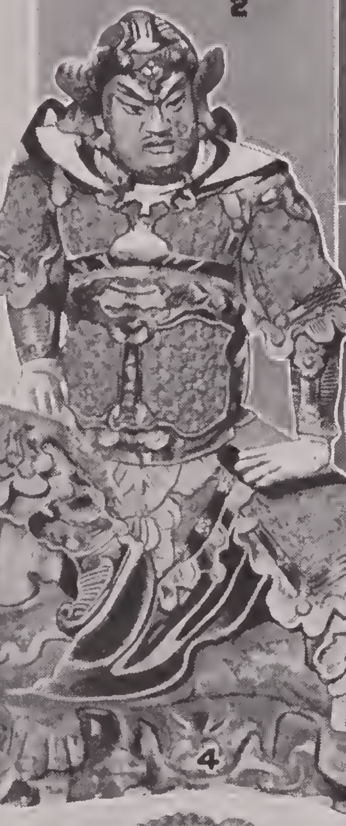
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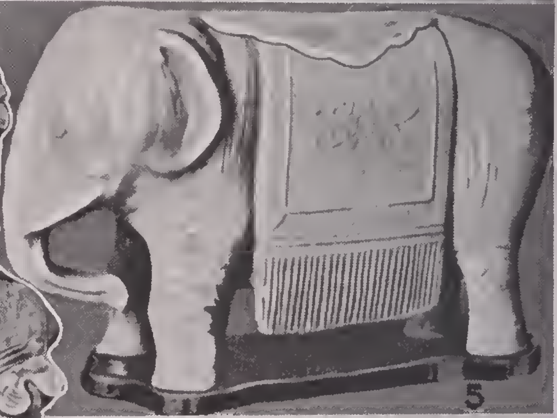
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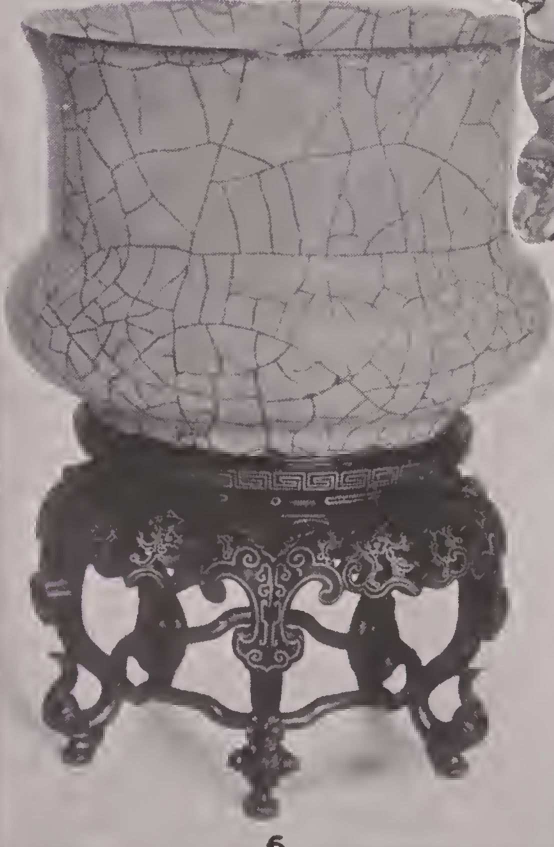
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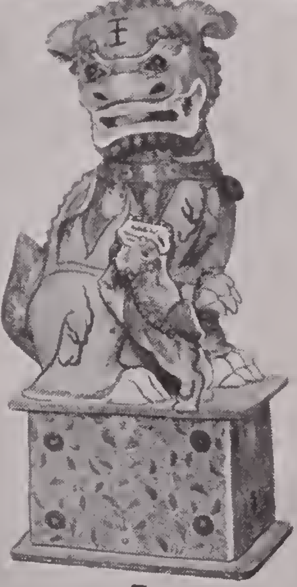
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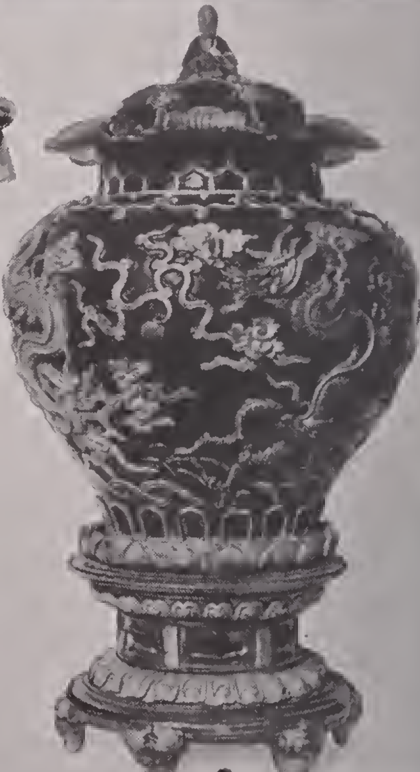
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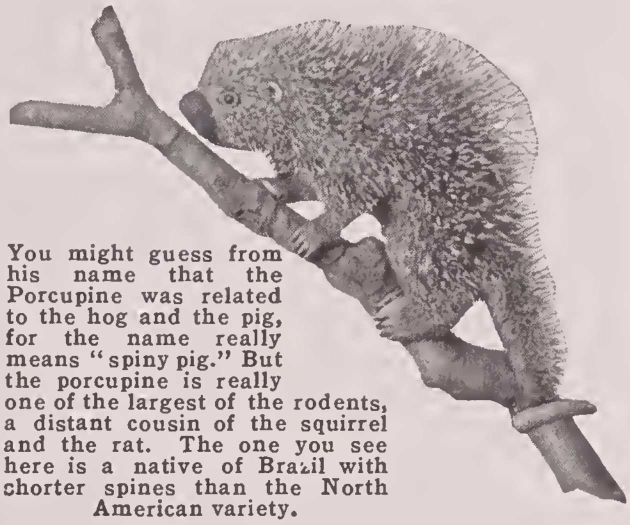
The making of porcelain has undoubtedly had its highest development in China, as you can see from the examples on this page. All of these, except numbers 1 and 3, which are Royal Dresden or Meissen, are Chinese. 2. Cock of the K'ang Hsi period dating from about 1700 A. D. 4. War God of China, 16th century. 5. Creamy White Elephant made during the Sung dynasty, about 1100 or 1200 A. D. 6. Reddish brown bowl of the Sung dynasty, showing what is known as "crackled glaze." 7. One of the Lions of Buddha, from the K'ang Hsi period. 8. Wine jar with cover and stand of about 1500 A. D. It was at Meissen near Dresden in 1709 that the first successful imitation of Chinese ware by Europeans was made.

Japanese potters, who have produced some remarkably beautiful porcelain, did not experiment with the new material until the 16th century. The essence of the secret lies in the materials used: kaolin, a very fine clay; powdered feldspar, called by the Chinese *petuntse* and by the English "cornish stone"; and quartz or sand. Both kaolin and petuntse are the natural products of weathered granite. Kaolin consists chiefly of alumina and silica, and cannot be melted. Feldspar is a silicate of aluminum combined with soda, potash, and lime or barium. It melts at high temperatures, and by holding the kaolin in suspension as it cools gives the porcelain its beautiful translucent texture. Early European imitations, called "soft-paste" or artificial porcelain, were made of clay suspended in an artificial glassy medium. Beautiful wares were made of artificial porcelain, but they lack the characteristic hardness, depth, variety, and richness of true porcelain. They can be scratched with a file; while the hard-paste wares cannot. Moreover, they melt at lower temperatures and are much more difficult to fabricate; hence the process of manufacture was much more costly and uncertain and could be supported only by princes and men of wealth.

DON'T TOUCH HIM!



You might guess from his name that the Porcupine was related to the hog and the pig, for the name really means "spiny pig." But the porcupine is really one of the largest of the rodents, a distant cousin of the squirrel and the rat. The one you see here is a native of Brazil with shorter spines than the North American variety.

The Porcelains of Europe

The making of true or hard-paste porcelain in Europe dates from 1709, when a German named Boettger discovered kaolin and feldspar near Dresden and started the famous Meissen factory on its long career. Such importance was attached to this discovery that Boettger and his workmen were imprisoned in a fortress so that the secret would not leak out. But one by one the workmen escaped and carried the secret with them over Europe. Dozens of factories soon began making true porcelain, and their finest productions have brought prices that approach those paid for Chinese and Japanese wares. Dresden china, as that made at Meissen is called, and Sèvres ware, made at Sèvres, France, are the most highly esteemed varieties. Other famous factories were founded at Vienna, Berlin, Chantilly, Vincennes, St. Cloud, Copenhagen, and many other cities in Europe.

In England a third variety of porcelain, intermediate in hardness and whiteness between hard-paste porcelain and the soft-paste variety, was invented about the middle of the 18th century. This is "bone porcelain," so called because it is made of a paste similar to that of the true porcelain, but contains bone-ash, which renders it more easily fusible. The famous English potteries at Bow, Bristol, Chelsea, Derby, Lowestoft, Worcester, and elsewhere employed the bone porcelain almost exclusively, and were able to produce a pure white, hard, tough ware much more cheaply than the factories of Europe. This process is the one chiefly in use in the United States, and it has also taken firm root on the continent of Europe.

The process of molding, firing, and decorating porcelain is the same as in other forms of pottery (*see* Pottery).

PORCUPINE. "Like quills upon the fretful porcupine" is a comparison that has been common ever since Shakespeare put it into the mouth of one of the characters in 'Hamlet'. This large but sluggish rodent is remarkable for its defensive armor of quills or spines, which usually lie flat on its body but are raised into a formidable and bristling array in time of danger. These spines, which are really hairs modified by long evolution, range from an inch or so to a foot in length, and are intermixed with the animal's hair. The general color is a grizzled black or brown mingled with white.

The best known American species, called the Canadian porcupine (*Erethizon dorsatum*), measures about two and one-half feet in length, including its short tail, and weighs up to 20 pounds. It is found chiefly in Canada and in New England, New York, Pennsylvania, and westward. Its days are spent in hiding in hollow trees and among the rocks, feeding chiefly at night. It is practically omnivorous so far as fruits and vegetables are concerned, and feeds upon the bark and twigs of many of the trees, and on the leaves and stems of water plants. It is a good climber in spite of the fact that its tail is not prehensile, as is the case with some species. The flesh of the porcupine is edible and is considered quite a delicacy by the Indians. The laws of some of the states protect it because it is a source of food to persons lost in the woods. The Indians dye the spines various colors and use them in their beadwork. In the Old World porcupines, of which there are a number of species, alike in Europe, Africa, and Asia, usually live in burrows. All porcupines are great gnawers, and around camps in the northern woods of America boards and planks may usually be seen which have been gnawed through for the bacon fat or salts which they contain.

Contrary to a common belief, the porcupine cannot "shoot" its quills at its opponents; such stories arise from the fact that the quills are loosely inserted in the skin and become detached at a touch. Although the porcupine is quite harmless if let alone, the quills make painful wounds, for small barbs at their tips cause them to work deeper and deeper into the flesh of their unfortunate victims.

The porcupine is sometimes incorrectly called a hedgehog. The hedgehog is not a gnawing animal but an insect-eater, is smaller and weaker, and is not found in America (*see* Hedgehog).

PORPOISE (*pôr′pŏs*). All those friendly inhabitants of the sea which play around ships, leaping from the water in graceful curves, are commonly called "porpoises" by sailors, although most of them are really dolphins (*see* Dolphin). However, the true porpoise, who is distinguished from his first cousin the dolphin by a blunt snout, instead of a sharp beak-like nose, is one of the friendliest of the group. He usually lives along the seacoast, and often swims into rivers and harbors to show off before the passengers of ferry boats. Many a startled landsman, seeing the shining body of a porpoise threshing about in the water, has raised the cry: "Man overboard!"

As a matter of fact, the porpoise probably makes friends with man because he has no friends in the sea. He devours cheerfully nearly all smaller creatures that come his way, and he is a fierce and frequent feeder.

The porpoise (*Phocaena communis*) is not a fish. It is a mammal, like the whale, to which it is distantly related, and young porpoises get their milk from their mothers. Like the whale, also, it has tiny ear openings and a single nostril or "blow-hole," which is opened during the animal's frequent trips to the surface for air. The tail is horizontal, not perpendicular like the tail of fishes. Two "flippers" or fins serve as fore-limbs, and most species have a fin on the back. There are about 40 teeth in each jaw. The body is black on top and white underneath, creating a startling contrast as he turns over while swimming.

Porpoises are common on the coasts of the North Atlantic, where their chief food consists of mackerel and herring. The bay-porpoise of the Pacific coast is the smallest member of the whale group, being often not more than four feet long. Other species reach eight feet. Their thick hide is sometimes made into soft leather and their fat yields oil of especially fine quality (*see* Whale).

A particularly interesting relative of the porpoise is the narwhal (*Monodon monoceros*). In the male narwhal one of the teeth of the left upper jaw projects forward in a long straight tusk, about half the length of the body. The full-grown narwhal has a body about 16 feet long. Narwhals are found chiefly in the Arctic Ocean.

PORTER, DAVID DIXON (1813–1891). Second only to his foster-brother, Admiral Farragut, in naval achievements during the Civil War was David Dixon Porter. He was the son of Commodore David Porter, who had commanded the famous frigate *Essex* during the War of 1812. As a boy he had had an exciting career. At the age of 12 he sailed with his father in an expedition against the pirates in the West Indies, and when 14 he entered the Mexican navy of which his father was, for a time, commander-in-chief. While in this service he was captured by the Spaniards with whom Mexico was then at war. After his release he entered the United States navy as a midshipman, in 1829, saw service on a paddle-wheel steamer in the Mexican War, and made two trips to the Mediterranean countries to procure camels for army use in the Southwest.

At the outbreak of the Civil War, Porter was promoted to the rank of commander in the navy and during the war he helped to win three important victories. First, when Farragut attacked New Orleans, in April 1862, Porter's fleet of mortar-boats bombarded the forts below the city so fiercely that Farragut was able to pass through in comparative safety and capture the town. Then, with a fleet of gunboats Porter coöperated with Grant in the siege of Vicksburg, guarding the city so closely by water, while Grant cut it off from outside communications by land, that it was forced to surrender on July 4, 1863. Finally, in the attack on Fort Fisher, in 1865, Porter—now a rear-admiral—commanded the fleet which coöperated with the land forces of General Terry, helping to capture that fort, and with it Wilmington, N.C., one of the last Atlantic ports open to the Confederates.

At the close of the war, in 1865, Rear-Admiral Porter was made superintendent of the naval academy at Annapolis. As a final recognition of his services, he was appointed in 1870 to succeed Farragut as an admiral of the United States navy, a rank which was not given to another until 1899, when it was conferred upon Rear-Admiral Dewey for his victory over the Spanish fleet at Manila Bay.

PORTER, WILLIAM SYDNEY ("O. HENRY") (1862–1910). "A man may see so much that he'd be bored to turn his head to look at a $3,000,000 fire or Joe Weber or the Adriatic Sea. But let him herd sheep for a spell and you'll see him splitting his ribs laughing at 'Curfew Shall Not Ring Tonight', or really enjoy himself playing cards with ladies."

When America's most popular short story writer wrote that, he was probably thinking of the sheep-herding days of his own eventful career. As a shy freckled small boy in his native town of Greensboro, N.C., William S. Porter,—who became famous under the name "O. Henry"—was fond of 'The Arabian Nights' and other books, of roaming in the fields by himself, of cartooning his friends, and of spinning for them many exciting yarns. Even in those days he was "different." He once explained with modest pride that his feet were freckled.

After attending a school kept by his aunt, young Porter continued his education only in the "School of Good Books" and in the "University of Hard Knocks." Ill health compelled him to give up clerking in the town drug store and to go to work on a friend's ranch in Texas. There in the Southwest he also tried writing short stories, working in a bank, and making up jokes for the papers. After eloping one moonlight night in a borrowed "buggy" with a charming young schoolgirl, he began experiencing the ups and downs of a varied journalistic career. For a year he edited a humorous weekly called *The Rolling Stone*, furnishing most of the copy himself. After this he worked for a time on the Houston *Post*.

Then came a bitter experience. He had resigned some time before as teller of the First National Bank of Austin. Now he was called back to answer a charge of embezzlement. The affairs of the bank had been handled so loosely that, long before, Porter had protested that it was impossible to make the books balance; and if he had stood trial he would doubtless have been acquitted of all wrongdoing. But he impulsively decided that rather than face the trial he would start life over again in a new place. He went to Central America, meaning to make a home there; but when he heard of his wife's illness, he returned to Texas and gave himself up. The fact that he had fled from justice weighed heavily against him and he was sentenced to the penitentiary. After his release, in 1901, he went to Pittsburgh, and the following year he settled in New York. Something of his old light-heartedness was gone, but his character had been deepened and strengthened and his experience broadened, and it was now that his literary work began in earnest.

A genuine democrat, "O. Henry" was fond of prowling of nights through streets and alleys among the worst specimens of "down-and-outers." Although he sold his diverting stories for big sums, he never had enough money for himself. Yet there was always plenty to give away secretly to the unfortunates he met. He saw deep down into the heart of New York. And in his original and delightful stories —of clubmen, fighters, thieves, policemen, shopgirls, lady cashiers, hoboes, actors, stenographers, etc.,—he showed that he realized the full significance of everyday joys and sorrows.

This much beloved and truly American writer died just nine years after he came to New York. "Turn up the lights," he whispered to the nurse at his bedside just before the end. Then remembering a popular concert-hall refrain, he added with a smile, "I don't want to go home in the dark!"

"O. Henry's" short stories were published in the following volumes: 'Cabbages and Kings' (1905); 'The Four Million' (1906); 'The Trimmed Lamp' (1907); 'The Gentle Grafter' (1908); 'The Voice of the City' (1908); 'Options' (1909); 'Whirligigs' (1910); 'The Two Women' (1910); 'Strictly Business' (1910); 'Sixes and Sevens' (1911); and 'Rolling Stones' (1912).

PORTLAND, Ore. Roses—millions of roses! One sees them early each June at Portland's "Reign of Roses," a week of revels when the city holds carnival on land and water to do homage to these beautiful flowers, which bloom in its mild climate all the year round—flowers which the Willamette Indians called Oregon's "tomanowos," or "good signs from the gods."

Portland lies cradled between the Cascade Mountains and the Coast Range, on both sides of the Willamette River just 12 miles from the point where it joins the Columbia. Its progressive business district and its beautiful residences extend back on a rising slope to the fir-lined foothills, behind which tower the distant snowcapped peaks of Mount Hood, Mount St. Helena, and Mount Adams. One of the finest scenic automobile drives in America is the Columbia Highway from Portland up the south bank of the Columbia.

Its situation in the midst of heavily timbered mountains and amid the marvelously fertile valleys of the Willamette and the Columbia, together with its excellent position on one of the largest fresh-water harbors in the world, make Portland Oregon's largest and most important commercial city. From this harbor, which has a 28-mile frontage and is about 100 miles by water from the Pacific Ocean, ships sail to the Orient, to Pacific coast ports, to European ports, and to the Atlantic coast via the Panama Canal. Portland is among the largest lumber-manufacturing cities and lumber-shipping centers of the world; during the World War of 1914–18 it was the governmental headquarters for spruce production for airplanes, and its shipyards turned out hundreds of ships. From here is also shipped much of the wheat raised on the Pacific coast, and it is also a leading wool center. Portland is 183 miles south of Seattle and 774 miles northeast of San Francisco.

Aside from its lumber and wheat, the city manufactures furniture, flour, paper, woolen goods, harness, saddlery, and machinery. It is an important packing house center and much fresh fruit and salmon are canned and shipped. By tossing a coin the two New Englanders who in 1843 established a settlement here decided to name it Portland instead of Boston. The city's charter dates from 1851, and its commission form of government from 1913. The Lewis and Clark exposition was held here in 1905. Population, about 260,000.

PORTO RICO (*pōr'tō rē'kō*). In the warm waters of the Caribbean Sea, just east of Haiti, lies the rich tropical island possession of the United States, Porto Rico ("rich port"), where sugar cane is king. The island, which is roughly rectangular in shape, is smaller than Connecticut (3,600 square miles). A range of mountains 2,000 to 3,000 feet high (El Yunque, 3,700 feet, is the highest peak) crosses the islands from east to west. The wide northern slope is a mass of dark green tobacco fields on the lower hillsides, deep red-berried coffee shrubs above, and waving fields of sugar cane on every flat. On the southern face, which is much narrower and semi-arid, irrigation is necessary to grow crops; for the moisture-laden northeast trade winds, which blow the year round, drop all their precious burden on the north side of the mountains. The thermometer rarely rises above 100 degrees or falls below 50 degrees.

Only Cuba, the Hawaiian Islands, and Louisiana raise more sugar cane than Porto Rico, and of all her exports sugar products comprise more than half. Tobacco is the second crop, and the coffee plantations also constitute an important part of the island's wealth. Under the rule of the United States fruit growing has greatly increased. Oranges, grapefruit, pineapples, and other tropical fruits are now being profitably grown. Coconuts, too, are an important product. Hundreds of acres are devoted to sea-island cotton and farmers are being encouraged to increase the acreage as well as to improve the quality. Textile fibers, guano, phosphate rock, and vegetables are other products. Nearly two-thirds of the people are engaged in agriculture and the agricultural experiment station at Mayaguez is constantly adding to the list of crops which can be raised in this moist hot climate. On the northern and eastern slopes of the island cattle are extensively raised.

Gold, copper, iron, and other metals exist, but there is virtually no mining. The summits of the mountains are covered with limestone formations and there are very productive salt works. Originally the island was covered with beautiful virgin forest, much of which has been ruthlessly cut down. It is still famous, however, for the beauty and size of its trees—several species of palm, rosewood, sandalwood, Spanish cedar, mahogany, and dye-woods.

The manufactures—except of lace and embroidery—are directly dependent upon agriculture. First among these come sugar and molasses, in the production of which the most modern methods are now employed, and then the manufacture of cigars and cigarettes and the cleaning and polishing of coffee. At the seaports—San Juan, Ponce, and Mayaguez, which are also the principal towns—you may see in warehouses down near the wharves groups of native women on the floor of sorting rooms, with wide flat grass baskets into which they are putting green coffee berries, cleaned and graded.

The island has a population of about 1,300,000, 65 per cent being white, the remainder negroes and mulattoes. In spite of the sanitary and educational work of the United States officials, the condition of the common people is pretty bad. Anemia and ill health are widely prevalent, and labor is poorly paid.

THE ISLAND CAPITAL OF PORTO RICO

San Juan, a city of about 71,000 people, lies on a small coral island on the north shore of Porto Rico. It is surrounded by picturesque old walls, and the cliffs on the sea side have been strongly fortified. On the promontory at the west end of the island rises Morro Castle, which was bombarded during the Spanish-American War by an American fleet under the command of Rear Admiral W. T. Sampson. San Juan was founded in 1511 by Ponce de Leon, whose tomb is in the cathedral. It was first called "San Juan Bautista de Puerto Rico," but the last part of its name soon came to be applied to the island.

Compulsory education was introduced in 1899, during the military occupation, and many teachers were brought from the United States and a complete system of schools established; but nearly half of the population is still illiterate. In the rural schools all the teaching is in Spanish, except a class in English as a special subject in all grades above the first. English is the language of the city schools, but Spanish also is taught. A government university for men and women, established in 1903, is maintained near San Juan.

Railroads connect cities along the coast, but the interior still sends its produce to the ports in great tarpaulin-covered freight wagons drawn by several teams of mules, or occasionally on weary little donkeys whose drivers, astride their backs, do not begin to be as big as the great reed paniers crammed with broad tobacco leaves swinging on either side of their mounts. Passengers and mail are conveyed in public auto-busses. This inland transportation is benefiting by the extension of macadamized roads.

San Juan, the capital and largest city (about 71,000), is on an island off the north coast, connected

A PORTO RICAN TOBACCO FIELD

Next to sugar cane, tobacco is the most important Porto Rican crop. The plants you see in the foreground are being grown under the shadow of fine cheese-cloth, to improve the delicate quality of the leaf. The huts are used for storing and drying the leaves.

with the mainland by a bridge. The harbor is excellent. The whole city, with its flat red-tiled roofs and buildings covered with many-colored plaster, its plazas and trees, its narrow clean streets paved with glazed brick, its churches, castles, and fortifications against the background of mountains, makes a charming picture.

Porto Rico became a possession of the United States in 1898, by the treaty which closed the Spanish-American War. By an act of Congress of 1917, American citizenship was granted to the people of Porto Rico, and certain changes in the government were made.

Government under the United States

The government is in the hands of a governor appointed by the president of the United States, and a senate and a house of representatives elected by the Porto Ricans. All laws are subject to the approval of the government at Washington. The legislature elects a delegate to Congress, who, however, has no vote in that body. Local government is entirely in the hands of the people of the island. The death rate has been reduced by wise sanitation from 40 to 19 per thousand, wages have been increased, and the evils dating from Spanish days are slowly being removed.

Porto Rico (or Puerto Rico) was discovered by Columbus on his second voyage in 1493 and was named by him San Juan Bautista. In 1508 Ponce de Leon explored the island searching for gold, and two years later, having been appointed governor by King Ferdinand of Spain, began its conquest. Under the rigorous Spanish rule the Indians had disappeared before the end of the 16th century and African negroes were imported as slaves. The English at various times in the 16th, 17th, and 18th centuries, and the Dutch in 1625, unsuccessfully attacked the island, and it remained under Spanish rule until 1898.

PORTSMOUTH, ENGLAND. On Portsea Island, between two inlets of the English Channel, about 74 miles southwest of London, is the great English naval station and arsenal of Portsmouth, whose fine wharves and dry docks, excellent harbor, and strong fortifications are not excelled in any part of Great Britain.

Portsmouth is really made up of four distinct towns. Portsmouth proper, whose streets are full of soldiers, is the garrison headquarters. Portsea, the royal naval station, has almost 300 acres of busy dockyards, where at clanging dry docks amid great enclosed basins, grim mighty war vessels, swift yachts, great ocean liners, barges, fishing craft, torpedo boats, and submarines are constantly being built and rebuilt. The two other towns of the community are Landport, occupied chiefly by houses of the workmen, and Southsea, a fashionable summer resort, that commands a fine view of the channel of Spithead and of the Isle of Wight. Population, more than 230,000.

LITTLE PORTUGAL *and Her* GREAT PAST

POR'TUGAL. Like Holland, Belgium, or Great Britain, Portugal is a small country with far-flung colonial possessions. Its mainland area, covering a small strip along the Atlantic coast of the Iberian peninsula, is only about equal to that of the state of Maine, but its colonies even in its present decline are 27 times that size.

Extent.—North to south, greatest length, 362 miles; east to west, 140 miles. Area, 34,254 square miles (including Azores and Madeira Islands, 35,490 square miles). Colonial possessions (Cape Verde Islands, Angola, Mozambique, Guinea, etc.), nearly 9,500,000 square miles. Population (continental Portugal), about 5,600,000.

Physical Features.—Much indented Atlantic coast line forming the west and south boundaries; numerous mountain ranges in the interior separated by river valleys (highest range, Serra da Estrella, about 6,530 feet). Principal rivers: Minho, Douro, Tagus, Guadiana.

Products.—Wheat, corn, rye, oats, barley, beans, potatoes, and other vegetables, figs, lemons, and other fruit, olives and olive oil, grapes and wine; live stock, wool; sardines and tunny fish; iron and iron pyrites, tin, tungsten, and coal; cork; woolen and cotton textiles; porcelain tiles and other pottery.

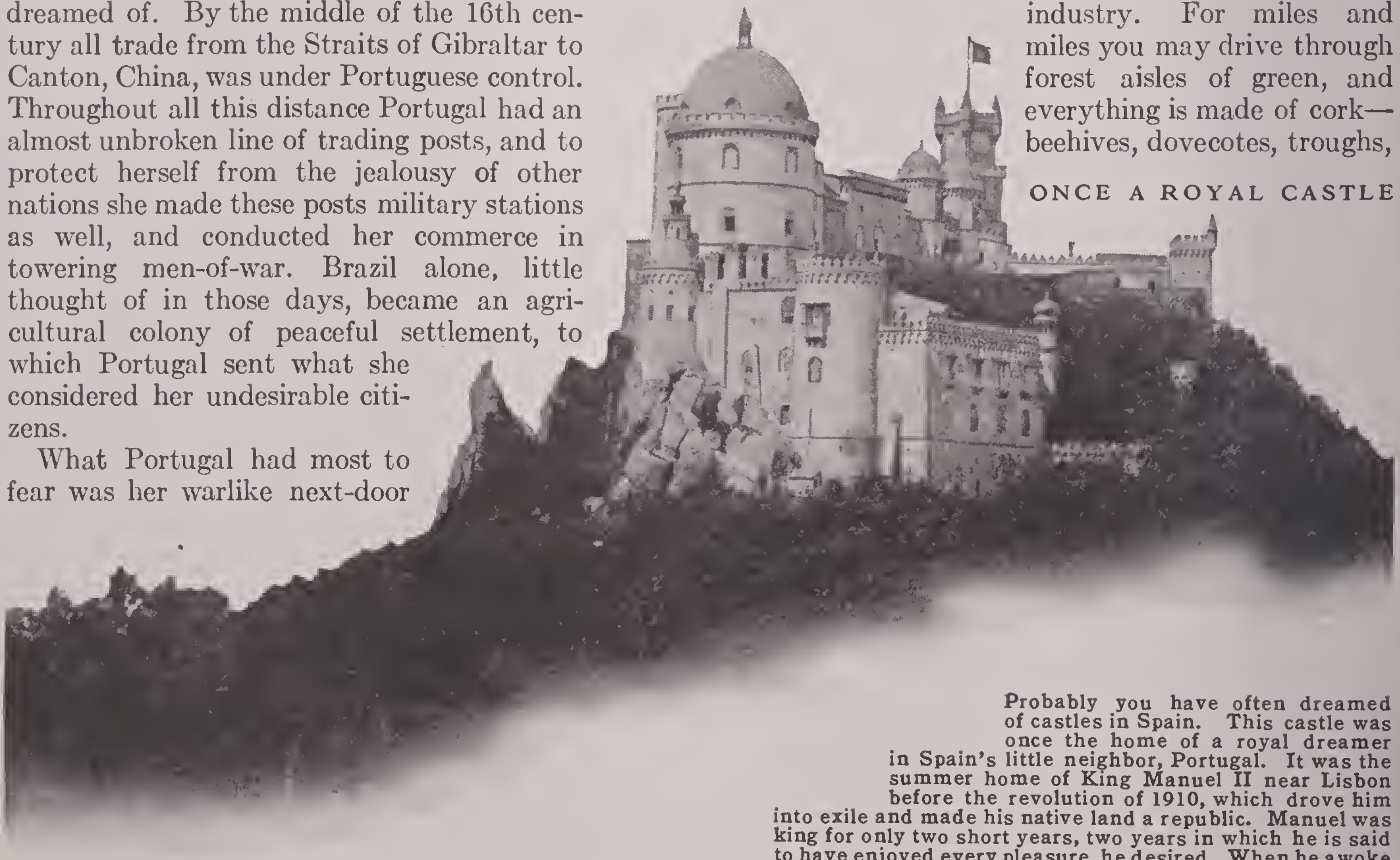
Chief Cities.—Lisbon (capital, about 440,000), Oporto (195,000).

These colonies are only a small remnant of the once glorious empire that Prince Henry the Navigator began building in 1412, when he encouraged expeditions to press farther and farther down the western coast of Africa. Portugal colonized the Canary Islands, Madeira, and even the Cape Verde Islands. Then about 1460, the year of Prince Henry's death, the Azores too came into Portuguese hands. Still more glorious advances remained for the end of the century, when Vasco da Gama sailed around the Cape of Good Hope and reached India; and other Portuguese navigators, seeking to avoid the coastwise currents of Africa, accidentally discovered Brazil in the year 1500.

Farther and farther Portugal's daring captains pressed, until they had extended the sovereignty of Portugal to an empire vaster than Alexander ever dreamed of. By the middle of the 16th century all trade from the Straits of Gibraltar to Canton, China, was under Portuguese control. Throughout all this distance Portugal had an almost unbroken line of trading posts, and to protect herself from the jealousy of other nations she made these posts military stations as well, and conducted her commerce in towering men-of-war. Brazil alone, little thought of in those days, became an agricultural colony of peaceful settlement, to which Portugal sent what she considered her undesirable citizens.

What Portugal had most to fear was her warlike next-door neighbor—Spain, six times her own size. There is no natural boundary between the two countries and the rivers and mountains of Portugal are almost all carried over from Spain. Northern Portugal continues the high central table-land, but owing to the rain-bearing winds from the Atlantic it has none of the barren aspect of Leon or Castile. The valley of the Douro, where the river flows along a ravine over a thousand feet deep, on either side of which rises terrace after terrace of vines, is one of the richest wine-producing regions of Europe. Grapes grow by the wayside, they hang from crags and trees, their trellises roof in the courtyard of cottage and farm, and as you walk along the village street you can almost touch the great six- or eight-pound clusters that hang from vines spanning the roadway between houses. This vine country, extending for more than 30 miles along the river, has as its market city Oporto near the mouth of the river, and it is from Oporto that the wine of the district takes its name, "port."

Central Portugal, especially Estremadura, the province in which Lisbon lies, is to a certain extent barren country, grazed by sheep, goats, and swine. In the province of Alemtejo you come upon the cork industry. For miles and miles you may drive through forest aisles of green, and everything is made of cork—beehives, dovecotes, troughs,



ONCE A ROYAL CASTLE

Probably you have often dreamed of castles in Spain. This castle was once the home of a royal dreamer in Spain's little neighbor, Portugal. It was the summer home of King Manuel II near Lisbon before the revolution of 1910, which drove him into exile and made his native land a republic. Manuel was king for only two short years, two years in which he is said to have enjoyed every pleasure he desired. When he awoke from his dream he found that he had lost his castle.

IF YOU WANT WATER YOU GO TO THE RIVER AND GET IT

Except in the larger cities, Portugal still lacks many of the conveniences which we associate with modern civilization. Running water in homes is almost unknown, and it is usual for the women to get the water supply for their households at a river bank or at a public well.

drinking cups, and even the tightly covered cork pail in which the workman keeps his lunch piping hot, as in a thermos bottle.

The extreme south of Portugal consists of the tiny province of Algarve, a garden country like the most fertile parts of Andalusia in Spain, where grow fruits in abundance—oranges, figs, almonds, olives, chestnuts, grapes, and the pulpy carob beans. Here also the fishermen draw from the sea rich catches of sardines and tunny. The little town of Sagres, at Cape St. Vincent, the very corner of the province, is famous as being the port where Prince Henry the Navigator lived and from which he sent forth his busy explorers. (For map of Portugal *see* Spain.)

PORT FROM OPORTO

This Portuguese sailboat is loaded with barrels of wine. Notice the strange long rudder, so like the sweeps of the ancient galleys that we are reminded that Portugal, like Spain, was once a Carthaginian and then a Roman colony.

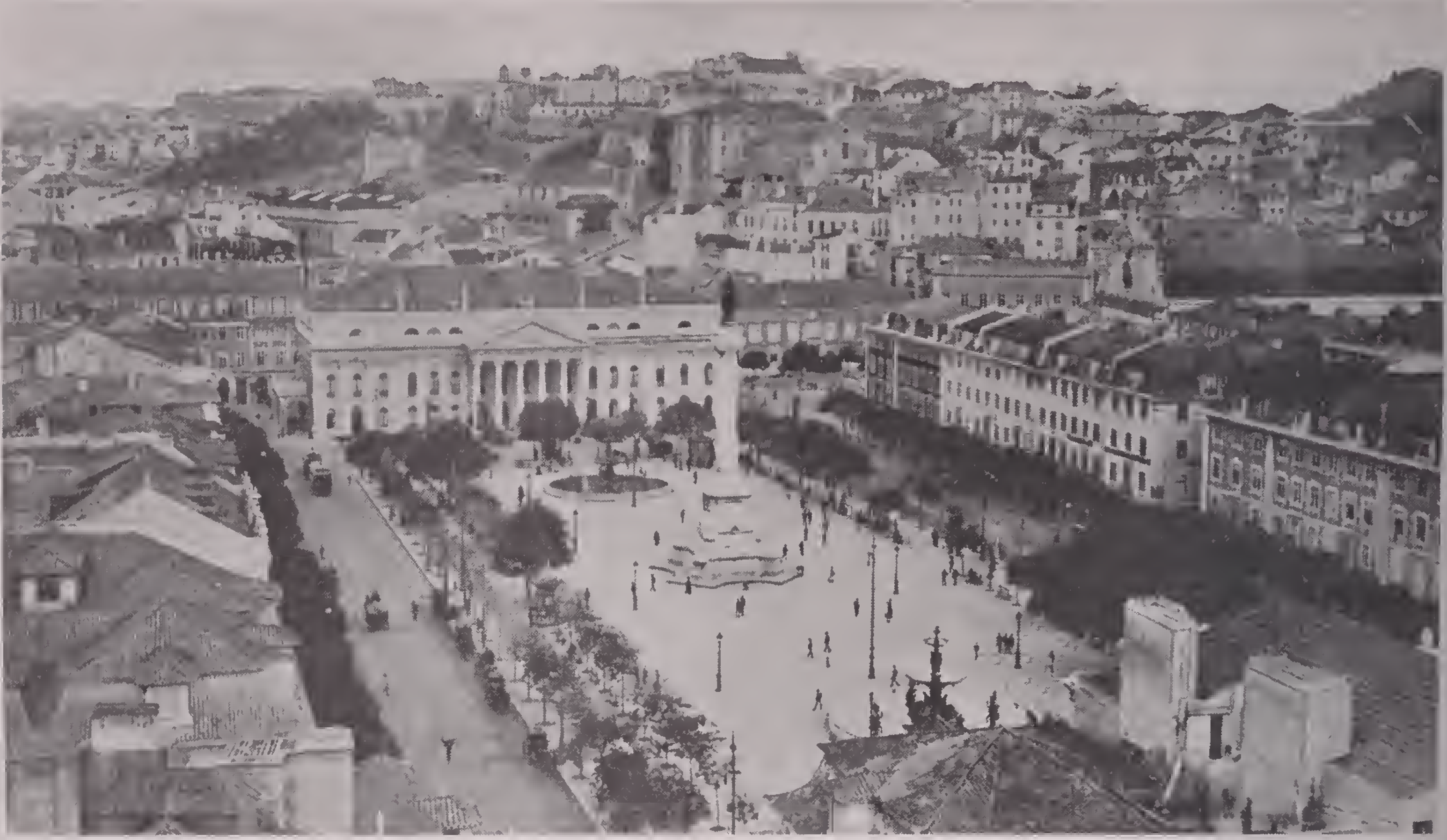
Portugal is believed to possess a subsoil rich in minerals, but mining and industry alike seem uncongenial to the Portuguese. In spite of tariff protection, the weaving of cottons and woolens does not flourish; the paper manufactured in Portugal is of poor quality; and the only really successful manufactured article is the *azulejo*, a green or blue glazed roofing tile. Portugal is compelled to import a good deal of her grain, a crop which is very successful wherever her farmers are willing to spare the soil for it.

The People and Their Culture

The Portuguese peasants have many feast days and pleasant customs, connected with summer pilgrimages and saints' days and the secular festivities of sheep-shearing and corn-husking. At such times you will hear a rich store of songs, proverbs, and folklore, and plenty of tales of ghosts and witches. The costumes are quite picturesque, especially when the women go to town, dressed gorgeously in red with gold ornaments and necklaces covering almost the whole bodice.

Portugal has three universities—at Lisbon, Coimbra, and Oporto; but although Lisbon is the great educational center for Brazil and for continental Portugal as well, the University of Coimbra is probably the only one which would meet exacting university standards. Portugal has little to show in music or in art. In literature she claims a place by reason of her 16th century poets, especially Luis de Camoens (1524-1580), whose 'Lusiad', commemorating the explorations of Vasco da Gama, ranks among the world's greatest epics. The language (which is also spoken

FARTHEST WEST ON THE CONTINENT OF EUROPE



Lisbon, the capital of Portugal, is situated on the promontory which marks the westernmost point of continental Europe. The view we have here shows the Square of Dom Pedro IV, famed the world over for the wavy pattern in its mosaic pavement. In the center of the square is a monument to Pedro IV—the last king of Portugal who was also emperor of Brazil. At the far end is the handsome national theater, named in honor of Queen Maria II, daughter of Pedro. While Lisbon has many such beautiful spots, the poorer quarters are exceedingly squalid and ill-improved.

in Brazil) is akin to the Spanish spoken in the neighboring province of Galicia. As spoken by the peasantry it is simple and beautiful, but as used by educated Portuguese it becomes a series of long words and still longer sentences with little literary promise.

History of Portugal

The early history of Portugal is much like that of Spain, except that the successive conquests of Carthage, Rome, and the Moors all penetrated to this remoter part of the peninsula in a weaker form, and that Portugal has been a maritime country from the beginning. It was partly reconquered from the Mohammedans by King Ferdinand I of Castile in the 11th century, who made it the County of *Portucalensis* (from *Portus Calo*, Latin for Oporto). It became independent of Castile and a kingdom in 1140. In 1580 the royal family of Portugal died out, and Philip II of Spain by force of arms seized the crown. Sixty years later (1640) Portugal emerged a free country but shorn of almost all her great colonial empire with its vast resources.

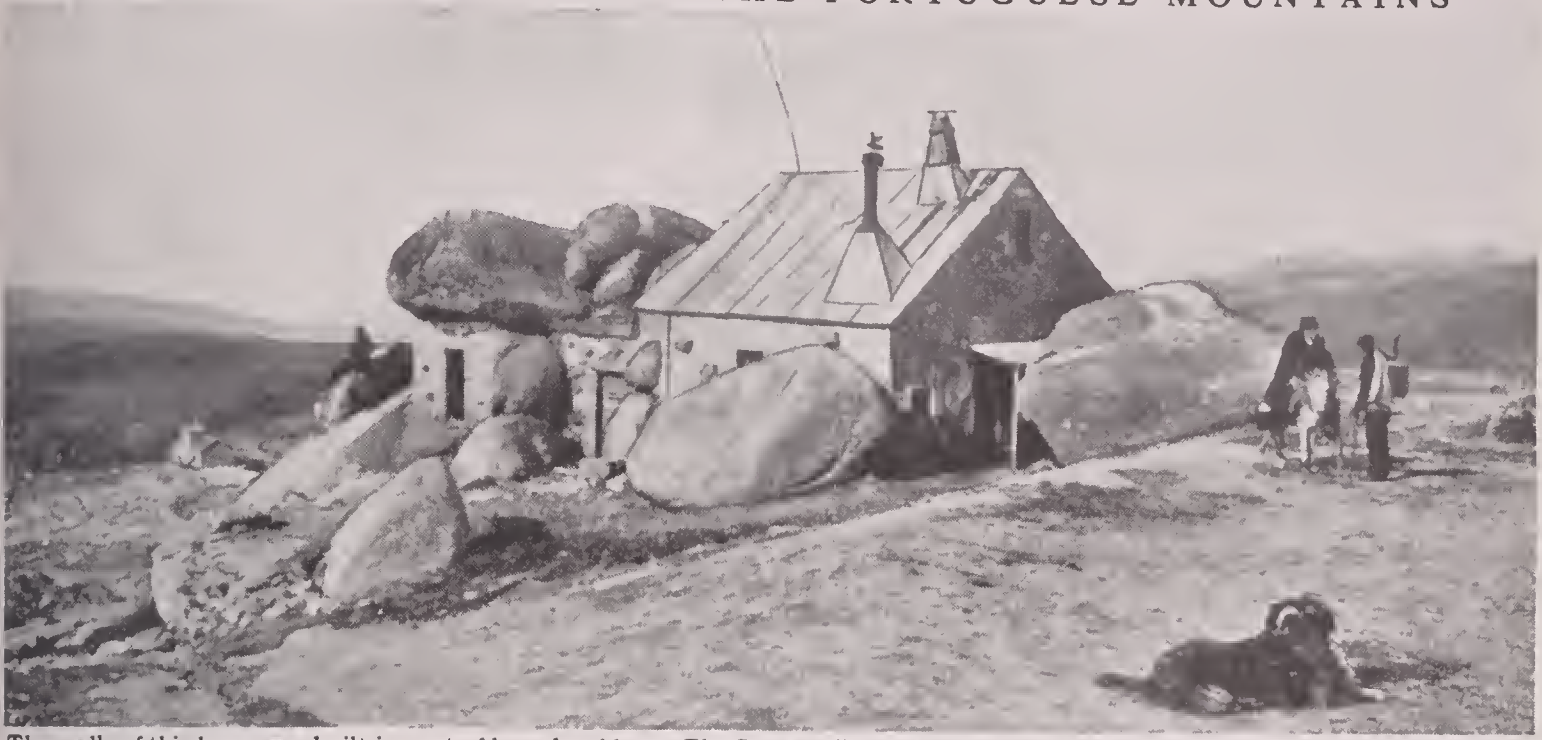
AN ANCIENT OXCART HAULING WINE

Like most of the agricultural equipment in Portugal, the peasant's oxcart looks as if it had been handed down from generation to generation for ages.

In 1703 the famous Methuen Treaty brought Portugal into a long political and commercial alliance with England. This taught Englishmen to drink port, preserved Portuguese independence, and in the World War of 1914–18 arrayed Portugal's troops alongside those of Great Britain on the Western front. It is the oldest existing alliance in European history.

When Napoleon Bonaparte overran the Spanish peninsula in 1807, the Portuguese king and royal family fled to their great American colony of Brazil. The British under Wellington cleared the peninsula of the French in what is known as the Peninsular War (1808–14). But the Portuguese king did not return until 1822, and then Brazil became an independent empire under his son, putting an end to Portuguese power in the New World.

A PEASANT'S HOUSE IN THE PORTUGUESE MOUNTAINS



The walls of this house are built in part of huge bowlders. The Serra da Estrella, where this house is situated, is the loftiest mountain range in Portugal, and forms a sharp line dividing the country, the climate, and the people. North of the divide the people are of Galician strain; south they show the influence of the Moors, Arabs, and negroes.

A revolution made Portugal a republic in 1910, following long continued civil wars, intrigues, party struggles, political corruption, and assassinations. Under the new constitution the government is in the hands of a National Council elected by the people, an upper house elected by the municipal councils, and a president, who instead of being voted for by the people is elected by the houses of congress. A system of districts, communes, and parishes patterned upon the subdivisions of the French government provides regional and local control. For purposes of government the Azores and Madeira Islands are counted integral parts of Portugal.

POSEIDON (*pŏ-sī'dŏn*). In the long-ago times of ancient Greece, Poseidon, the god of the sea, was supposed to live in a golden palace hidden from mortal vision in the depths of the Mediterranean. Here he held high court with all the sea divinities. The Nereids and Tritons attended him when he rode in his sea-shell chariot drawn by horses with necks arching like the curve of a wave, manes flying like the ocean spray, mouths foaming like the crest of a breaker, and brazen hoofs like the light on the sea. Dolphins played about his car, and at its approach the restless waters grew calm.

In his hand Poseidon carried his trident, a three-pronged spear, the symbol of his power. With one stroke of this, the mighty sea-god could shatter rocks, cause earthquakes, call forth storms, or lash the sea to such fury that the very earth shook with the beating of its waves. Mariners prayed to him as the giver of calms and of favoring winds, and in his honor erected temples on jutting headlands, and made sacrifices of rams and great black bulls. Poseidon was also god of all rivers and ruler of the lesser divinities of streams, springs, and fountains.

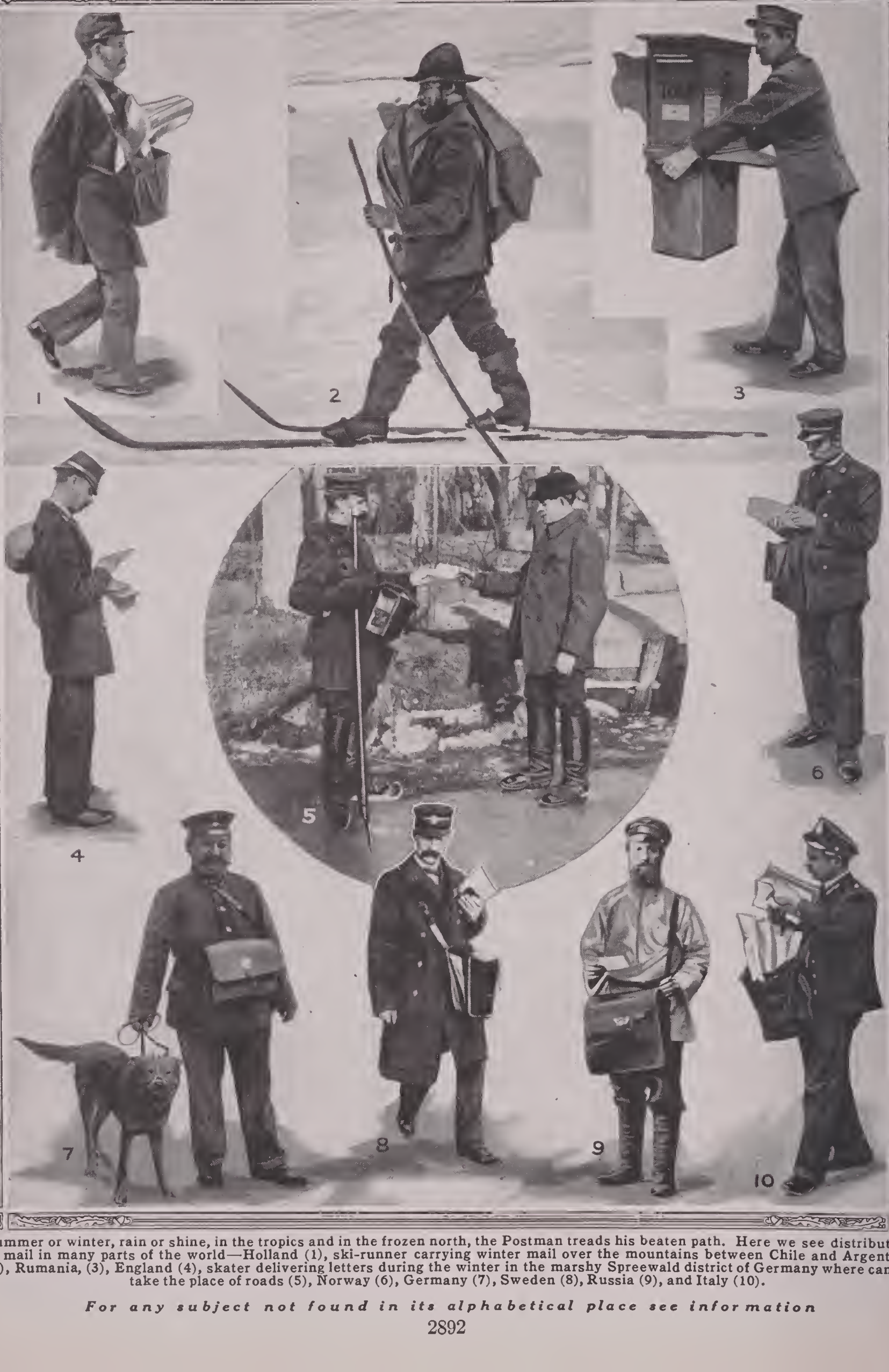
But for all his power, Poseidon was subject to the will of his brother Zeus, who was king of gods and men, and by whom he was once condemned to live for a year on earth among mortals.

It was at this time that Poseidon agreed with Laomedon, king of Troy, that for certain rewards he would build that city's mighty wall. In Homer's 'Iliad' Poseidon, speaking to Apollo, reminds that god how basely the Trojan king had treated them! "I round their city built a wall," he says, "wide and most fair, that the city might be unstormed; and thou, Apollo, didst herd shambling, crook-horned kine among the spurs of woody, many-folded Ida. But Laomedon robbed us of all hire, and sent us off with threats. He threatened that he would bind together our hands and feet and sell us into far-off isles, and the ears of both of us he vowed to shear off with his sword. So we went home with angry hearts, wroth for the hire he promised and gave us not."

Poseidon revenged himself at the time by sending a great sea-monster to ravage the plain of Troy; but Heracles (Hercules) slew the beast, and Poseidon nursed his grievance until the Trojan War. In that conflict between the Greeks and Trojans, Poseidon was always on the side of the Greeks, helping and encouraging them until at last the city lay in ruins. But on the return voyage of the Greeks to their native land Poseidon was hostile to Odysseus (Ulysses) and helped cause the ten years' wanderings of that much enduring hero (*see* Odysseus).

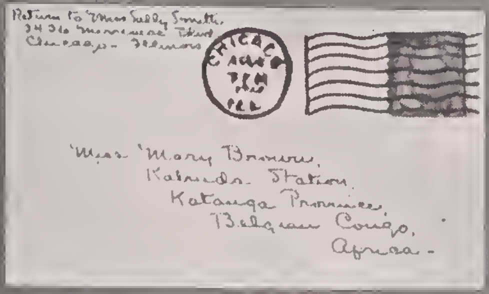
The Greeks believed that Poseidon was the son of Kronos and Rhea, and was the brother of Zeus and Hades, who ruled the world of earth and the underworld of the dead, as Poseidon ruled the sea. The Romans identified Poseidon with their god Neptune.

OVER THE WORLD WITH THE POSTMAN



Summer or winter, rain or shine, in the tropics and in the frozen north, the Postman treads his beaten path. Here we see distributers of mail in many parts of the world—Holland (1), ski-runner carrying winter mail over the mountains between Chile and Argentina (2), Rumania, (3), England (4), skater delivering letters during the winter in the marshy Spreewald district of Germany where canals take the place of roads (5), Norway (6), Germany (7), Sweden (8), Russia (9), and Italy (10).

TRAVELS *and* ADVENTURES *of a* LETTER


CHICAGO
ILL

Miss Mary Brown,
Katanda Station,
Katanga Province,
Belgian Congo,
Africa.

Civilization has always followed in the footsteps of the Postman. The Roman post roads brought culture to ancient Gaul, and the pony-express bridged the wildness of the early American frontier. Mail routes are the funnels through which pour ideas. The African savage running through the trackless forest with a letter on a stick is a messenger of progress.

POSTOFFICE. You drop a letter into the pillar box at your corner, and in an hour or two it is speeding on its way to any part of the world—to China or the heart of Africa, to New Guinea or some remote island of the Pacific. It is so easy to send a letter from one part of the world to another that we seldom stop to think what a wonderful organization the postoffice is. The postoffice department of the United States—the largest postoffice department in the world—employs more men than any single private business ever established.

There are more than 53,000 postoffices and more than 350,000 employees. They handle one-third of the mail of the civilized world, for the pieces—more than 17,000,000,000 a year—equal in number all the pieces handled in Great Britain, France, Germany, and Russia combined. Every hour, day and night, 750,000 to 850,000 letters are delivered. Every five hours as much is spent on the service now as was spent in an entire year of Washington's administration, when all the government postoffices in the 13 states numbered only 75.

With our swift mail trains and ocean liners, we little realize what letter-writing meant in olden times. You can write from Chicago today to a friend in New York and he will read your letter tomorrow. If you send it by airplane delivery, he will get it the same day. Yet in colonial times a trip of similar length would have taken a letter months. It took at least a week for the journey between Boston and Philadelphia, and the postage rates were so high that people wrote rarely.

Magic of the Postage Stamp

What happens to your letter, after you have placed upon it the magic postage stamp and slipped it under the little green lid of the nearest mail box? Well, it may have more adventures and travels than Gulliver. First, the letter is taken from the mail-box by the blue-uniformed postman or collector. Day or night, this "friend of everybody" is always on the job. Perhaps he is afoot, carrying a big leather bag or two of mail; or perhaps he has an automobile or a motorcycle or a horse-drawn "United States Mail" wagon, or he works from a postal street-car. He whisks your letter to the central postoffice, where workmen in shirt sleeves and aprons are wheeling big trucks full of letters around. Then, smash! The stamp is cancelled, and your letter is time-marked and dated in machines which work at the rate of 15,000 to 30,000 letters an hour.

How Mail is Delivered

If the letter is to be delivered in your own town it goes into the heap of other "local" mail, which is sorted by carriers' routes, the letters being tossed into big canvas bags by a squad of swift-working clerks, some of them perhaps on roller skates. If there are substations or branch postoffices it is sent to the proper station by trucks, or by pneumatic tubes (*see* Pneumatic Appliances), or other conveyances, such as the little electric cars that run in underground tunnels in New York City; and from the substation the carrier or mailman delivers it to the home or office of the person to whom you addressed it. If you put a special delivery stamp on it, a boy on a motorcycle or a bicycle rushes it to its destination as soon as it is received. Mail is delivered free of charge in towns with 10,000 or more inhabitants or with postoffice receipts which total at least $10,000 a year.

If your letter is for out of town, it is sent by trucks, elevators, pneumatic tubes, etc., to other departments of the postoffice, where clerks rapidly assort all the out-of-town mail from big tables and boxes into bags arranged in semicircular racks in front of them, one bag for each state. The bags of mail are rushed to the steamer docks or railway stations, where they are loaded by chutes into the "sea postoffices" of the ships or into the mail cars of the trains.

The railway mail car, "the backbone of the American postal system," is a miniature postoffice on wheels. The inside walls are a mass of pigeonholes; and the huge bags of mail are arranged all around the floor. As soon as the train is speeding on its way, the railway mail clerks, who must know from 5,000 to 20,000 postoffices and tell instantly on what railroad each is located, as well as a multitude of other points, sort the letters by towns and villages, tossing them into bag or pigeonhole with astounding speed and accuracy. Only once in 10,000 times is a mistake made. Mail that must change cars is thrown off at terminal and junction points, where it is sorted again. As the mail express roars past the small stations, an iron hook reaches out, automatically seizes a mail bag hung up over the station platform, and jerks it into the car, so that the train doesn't have to stop. By the time the car reaches its destination all mail going beyond that point has been sorted and placed in pouches ready for immediate delivery to the next outbound train. The railway mail car is the postal system's greatest time-saver.

An Austrian letter carrier in trim uniform.

Finally, when your letter arrives at its destination it is hurried to the central postoffice, where it is again assorted by substations or carriers' routes and then delivered.

But suppose your letter had been addressed not to a town, but to a farm, or some lonely ranch or mine. Then from the nearest postoffice it would be delivered by rural free delivery. Under this splendid system, which costs Uncle Sam about $50,000,000 a year, mail is delivered at regular intervals without extra charge by special carriers in "R. F. D." wagons or automobiles. Sometimes they must walk or ride horseback over deserts or forest or mountain trails, braving perils. In Alaska they travel in pairs, driving sled trains of Alaskan dogs over frozen wastes for sometimes as much as 1,000 miles. They must carry food, snowshoes, shotguns, cooking utensils, etc.; and frequently they have to stop to thaw out frozen feet, fingers, or ears. In Porto Rico some of them ride donkeys, to whose sides are strapped huge boxes of mail.

A veteran Danish carrier, still in harness.

Valuable letters and parcels may be transmitted by registered mail upon payment of a small extra fee. Mail so registered is put in special pouches provided with rotary locks, having a registering equipment, like that of a cyclometer or speedometer, which records the number of times the lock has been opened. Two clerks count the mail when it is put in, and two more when it is taken out, to prevent theft. If the mail is lost, the sender is indemnified for its value up to $25 for third-class and to $50 for first-class mail.

Redirecting the Misdirected

Suppose, now, that when you mailed your letter you had addressed it wrong or had forgotten to address it at all. That little stamp will still do its best to deliver it. It first takes it to the big dead letter office in Washington. More than 20,000,000 letters and parcels go there every year, containing $1,000,000 or so in valuables. Even snakes and dynamite have been found in packages opened there! Most of Santa Claus' mail is held for him in the dead letter office. Clever workers with maps, directories and the like "guess right" about half the time where the mail ought to go, and send it on its journey or return it with its valuables to its careless sender.

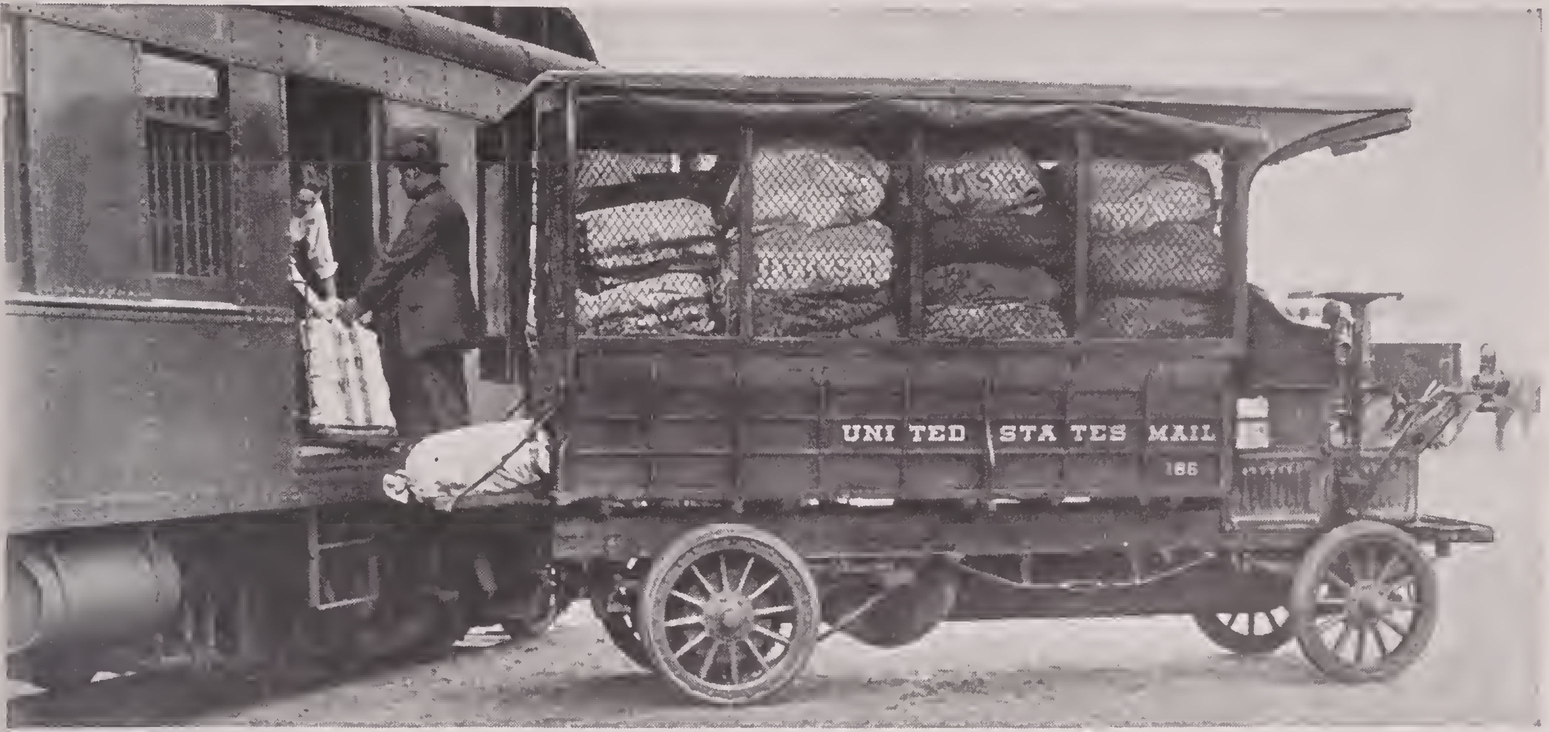
He has to read addresses written in Greek.

A package has much the same adventures as your letter. It travels by parcel post, which transports goods at much cheaper rates than the express companies. Parcels may be sent collect-on-delivery, and by special delivery, and may be insured against loss.

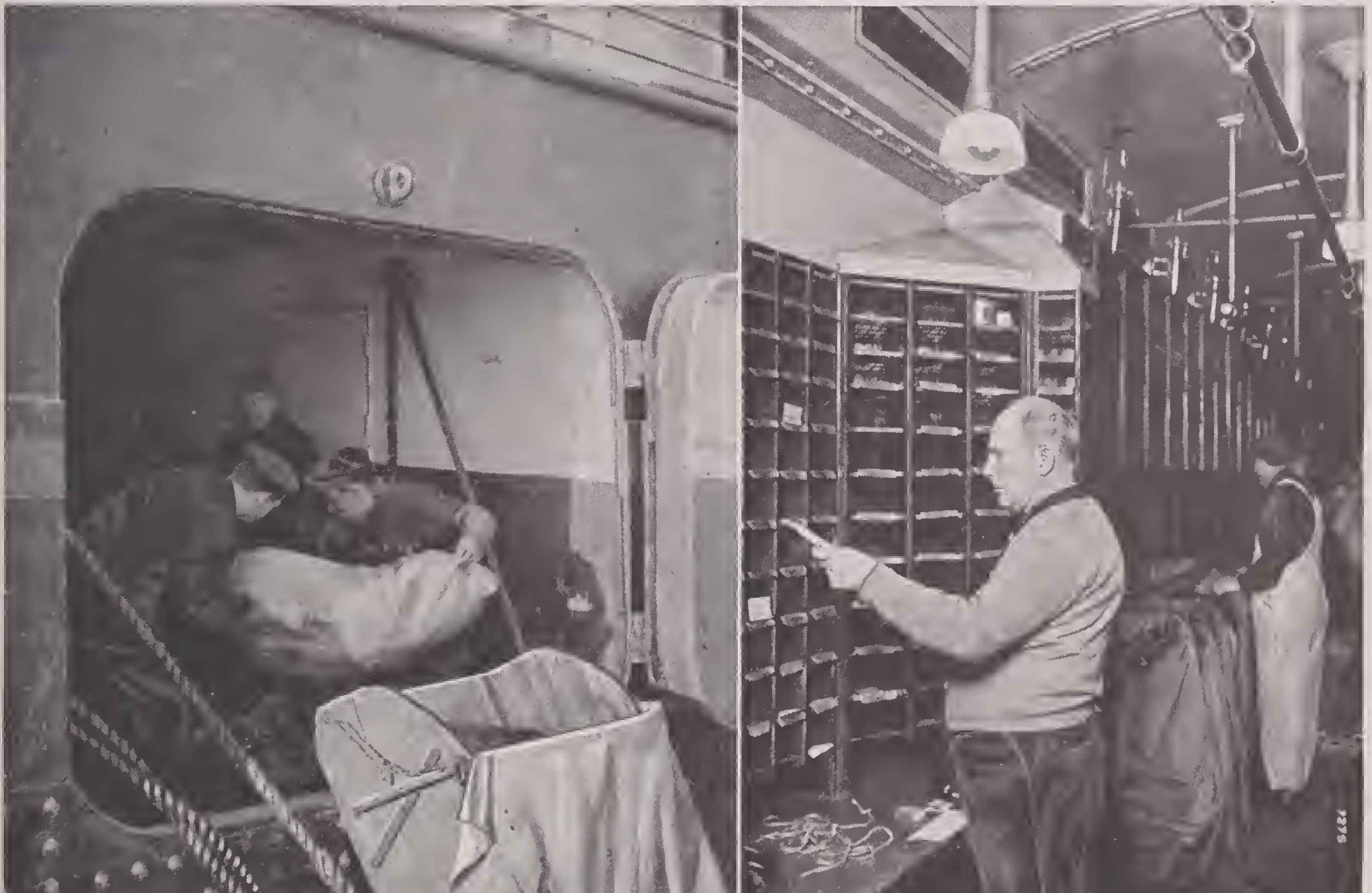
But not only does the postoffice department transport your letters and packages, but it does a bit of banking for you too—through the money-order division and the postal savings bank. The money-order division is one of the greatest clearing houses in the world. For a few cents money in the form of a postoffice check or draft may be safely sent to almost any point in the world. By means of the international money-order system money is also exchanged between different countries. Over a billion dollars is transferred every year through the money-order division.

Of scarcely less convenience to the public are the postal savings banks, established in all large postoffices. By these Uncle Sam encourages thrift, helping persons with small earnings to save money. Anyone more than ten years old may begin with a $1

SENDING MAIL BY RAIL AND STEAMER



A United States mail truck is delivering a heavy load to a railway mail car, which is really a traveling postoffice. The railways haul these cars under a contract with the government, and the men of the Railway Mail Service form a separate branch of the Post Office Department. Their duty is to sort out the letters and packages delivered to them, while the train is speeding on its way. They must work at lightning speed, for the mail destined for the different cities along the route must be sorted, and sacked, and sealed by the time the train reaches these points.



At the left we see the open side-hatches of an ocean liner which has just arrived in New York harbor from Southampton, England. Mail from Great Britain and perhaps other points in northern Europe is being thrown into a canvas-covered chute leading to the mail rooms on the dock. Before the last passenger has left the ship, this mail will be speeding onward to its destination. At the right is shown the interior of a railway mail car. The walls are lined with pigeonholes and racks for mail sacks, into which pour the streams of letters and parcels from the hands of the clerks. When passing stations where the train does not stop, mail is "picked up" by a steel arm thrust out from the car door, which snatches the sacks as they hang from "mail cranes" beside the track.

deposit, or with ten cents through a savings card system. Annual interest of two per cent is allowed.

Thus you see what a complicated organization Postman Uncle Sam maintains. But it was not achieved without many many years of development. Under the Persian Empire and the Roman Republic, official letters were transmitted by couriers from one end of the realm to the other, but private persons had to trust to chance opportunities for the conveyance of letters. The first postal system for the use of private persons, apparently, was established under Diocletian at the end of the 3d century A.D. Theodoric the Great, Charlemagne, and other great rulers started well-organized postal services. The University of Paris at about the end of the 13th century established for the use of its students the first postal system in France. A royal courier system established by Louis XI for his own use was continued by his successors, and at last private persons were allowed to use it. The first post in Germany was established by one of the petty German princes in the 15th century; it was extended and made permanent under the emperors Maximilian and Charles V. In Italy the postal system, which began in Piedmont, was at first in the hands of the city states and private persons. After 1561 it was farmed out to a postmaster-general, and from 1710 it was directly under the administration of the separate governments. In England private posts existed from the time of Edward III, and a royal messenger service, out of which the postal service developed, even earlier. A postmaster-general was appointed as early as 1533, in the reign of Henry VIII. The service was extended from time to time, but was not consolidated into one establishment until 1711.

THE LONG ARM OF THE UNITED STATES MAIL

In many of the remote outposts of Alaska, the mail service is the only regular reminder that Uncle Sam is thinking of his isolated people. Here we see a revenue cutter delivering mail on the edge of the Arctic circle. From the coast, dog sleds carry it to inland settlements across the trackless wilderness of snow.

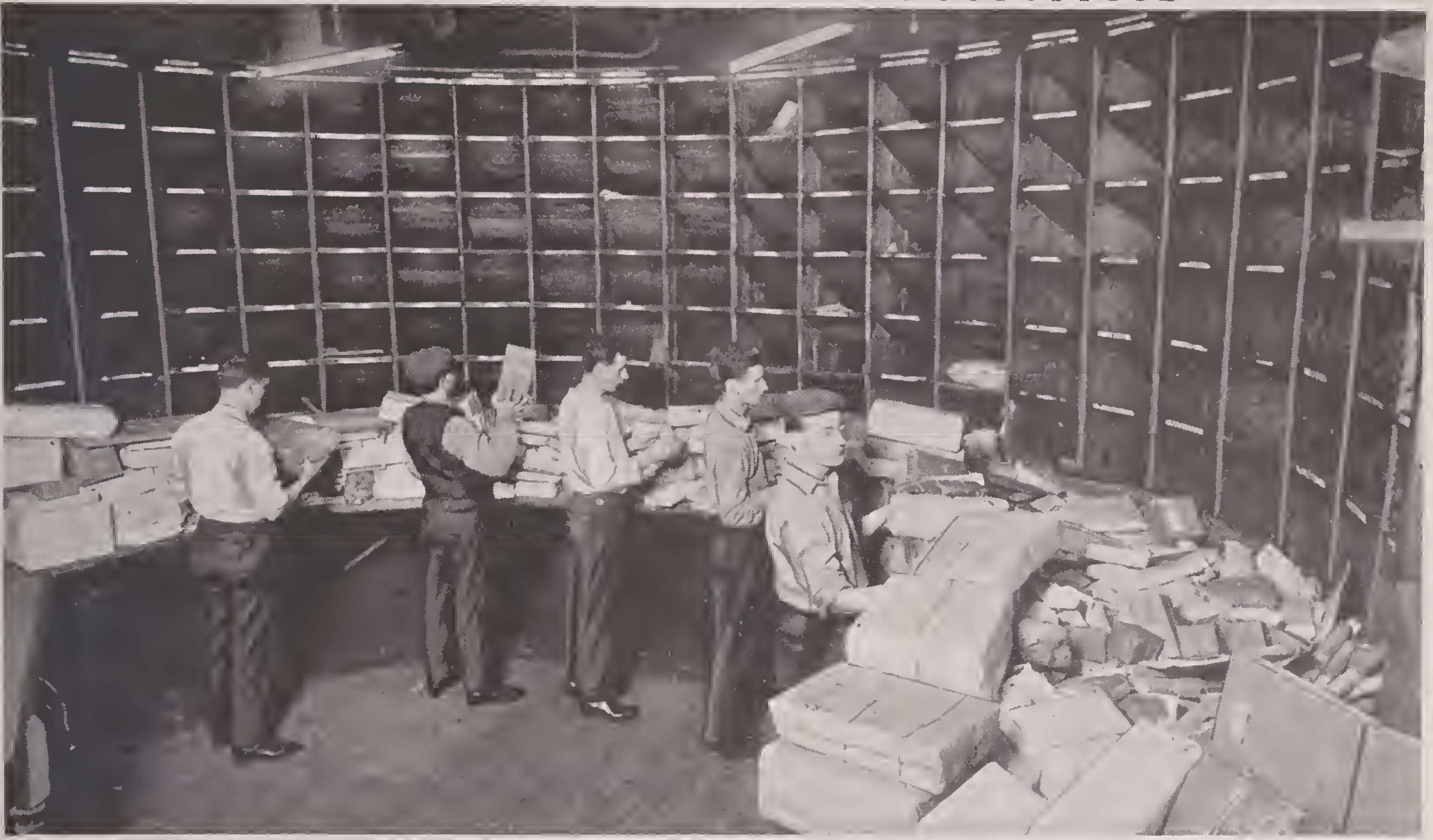
The beginning of a postal service in North America dates from 1639, when the Massachusetts government designated a Boston man to take care of the delivery and receipt of overseas letters. In 1657 Virginia established a postal service by requiring every planter to convey dispatches, as they arrived, to the next plantation. In 1672 the government of New York colony established "a post to go monthly from New York to Boston."

The first general postal system for the colonies began in 1692. A deputy postmaster-general for America was appointed, and by an act of Parliament in 1710 he was directed to keep his principal office in New York "and other chief offices in some convenient place or places in other of Her Majesty's provinces or colonies in America." The system, however, was a comparative failure until Benjamin Franklin was appointed postmaster-general by the British government in 1753. Franklin filled this office until 1774 with much ability and efficiency; when he was removed, the net revenue of the department exceeded $15,000, and the foundation of the present postal system of the United States had been laid.

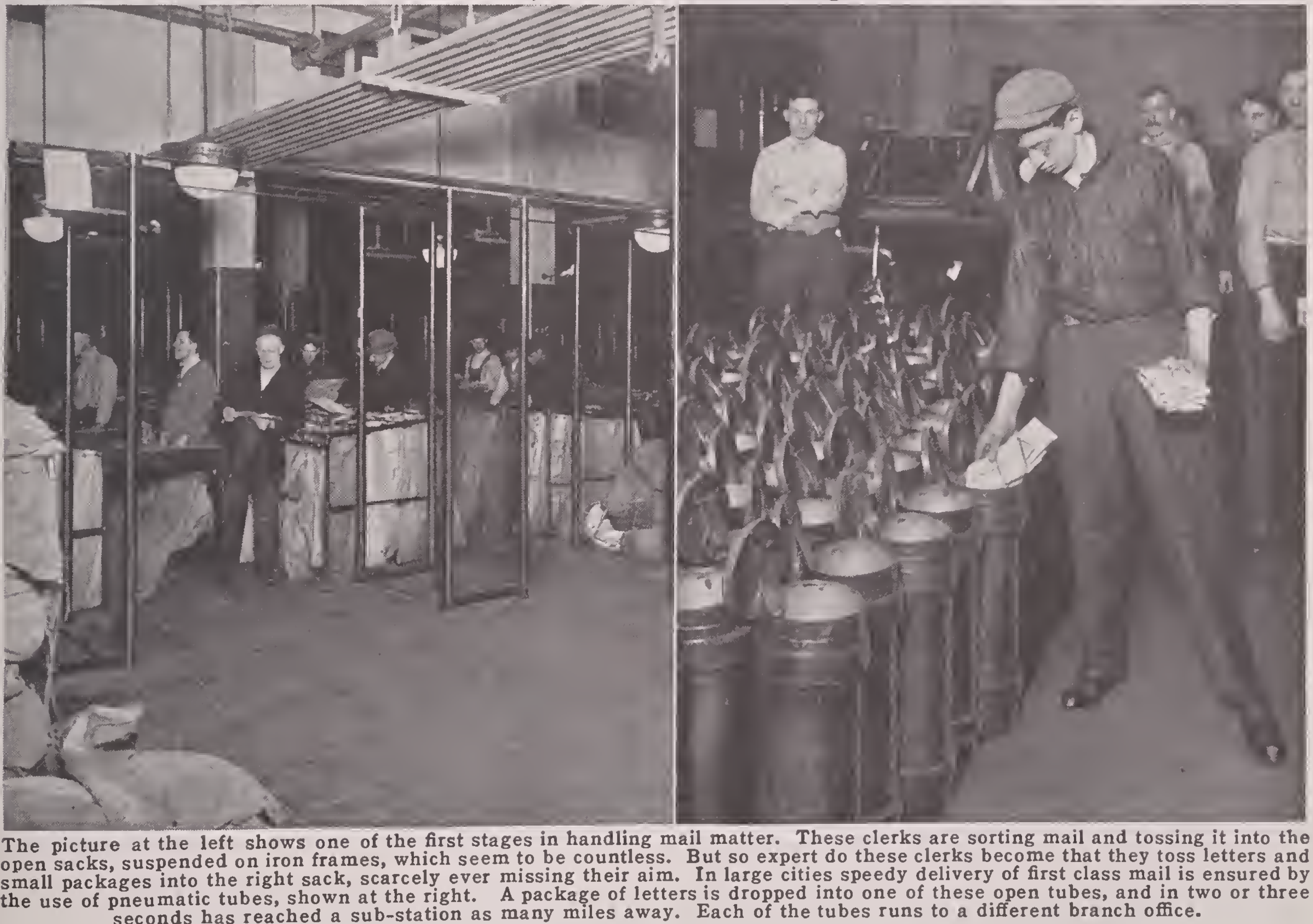
Even at the close of the American Revolution rates were still very high. The schedule in force for the first half of the 19th century charged six cents for a single sheet of paper going not more than 30 miles (envelopes were still unknown); between 30 and 80 miles, ten cents; and so on up to twenty-five cents for distances over 400 miles. Letters of more than a single sheet were charged double.

The greatest single advance in the history of postal systems was made as the result of the efforts of Sir Rowland Hill, a blind postoffice official of Great Britain, who introduced uniform penny postage and

IN THE WORLD'S GREATEST POSTOFFICE



The New York City postoffice handles more pieces of mail than any other postoffice in the world. In this room, in the downtown postoffice, parcel post packages are sorted into chutes according to their destinations. Over each chute is a label bearing the name of a state, or in a few cases, of a city. The cities are either large terminals like Chicago or San Francisco, or important railroad junction points, like Buffalo, Rochester, Providence, Newark and Minneapolis. The Buffalo chute, for example, will get not only all mail for Buffalo itself, but for branch lines radiating from there.



The picture at the left shows one of the first stages in handling mail matter. These clerks are sorting mail and tossing it into the open sacks, suspended on iron frames, which seem to be countless. But so expert do these clerks become that they toss letters and small packages into the right sack, scarcely ever missing their aim. In large cities speedy delivery of first class mail is ensured by the use of pneumatic tubes, shown at the right. A package of letters is dropped into one of these open tubes, and in two or three seconds has reached a sub-station as many miles away. Each of the tubes runs to a different branch office.

the adhesive postage stamp in 1839–40. Before his time postage was paid in money by either the sender or the receiver, and the rate varied with the distance as well as the weight, so that a letter within the limits of England often cost as much as a shilling (25 cents) postage. The chief features of the reform were the uniform rate irrespective of the distance, and the reduction to one penny (two cents). The chief purpose of the postage stamp was to make prepayment easy; double postage was collected on letters not prepaid. The introduction of the postage stamp also made possible the use of pillar letter-boxes, first introduced (in London) in 1855.

The success of these reforms led the United States to lower the rates in 1845, and to introduce the postage stamp in 1847. In 1851 a flat rate was instituted of three cents for letters weighing not more than half an ounce and going not more than 3,000 miles; six cents was charged for greater distances. In 1863 the rate of three cents was made general for all distances. In 1883 the rate was reduced to two cents for each ounce, carried to any part of the United States or its territories.

Other Landmarks in Postal History

Other important landmarks are the establishment of the dead-letter office in 1825; the negotiation of a postal treaty with England (1846); the introduction of stamped envelopes (1852); of the free delivery, railway mail car, and the money-order system (about 1863–64); of postal cards (1873); of stamped newspaper wrappers and envelopes bearing requests for the return of the inclosed letter to the writer in case of non-delivery; of the special delivery (1885), of the rural free delivery (1896); and the extension of the parcel post service in 1912 by reduction of rates and increase in the weight of parcels accepted for mailing.

The postoffice department is under control of the postmaster-general, who is a member of the president's cabinet, and four assistant postmasters-general, besides a large number of superintendents, inspectors, and other subordinates.

All postoffices in the United States are divided into four classes. The first class includes offices whose annual revenue exceeds $40,000; the second class, those whose revenue is from $8,000 to $40,000; the third class, those whose receipts are from $1,900 to $8,000, and the fourth class, those whose receipts are less than $1,000. Three-fourths of all postoffices in the country are in the fourth class, and the postmasters in this class draw salaries derived from a percentage allowed on the cancellation of stamps, etc.

The Four Classes of Mail Matter

All mail matter also is divided into four classes. The first class comprises sealed letters, postcards, and any other matter sealed against inspection. The second class embraces newspapers and all other periodicals issued regularly as often as four times a year. Third class matter includes, in general, all printed matter not issued periodically. The fourth class is the parcel post, and includes articles of merchandise, books, and in general all mailable matter not belonging by its nature to any of the other three classes. There are special rates of postage for each of the four classes. Postage to be sent by the aircraft routes established between some of the chief cities is 16 cents an ounce. Postage for letters to Newfoundland, Canada, Mexico, Panama, Cuba, Great Britain, Ireland, and to Germany (when carried in direct steamers) is two cents; to all other countries, five cents.

Between nations, uniformity in the transmission and delivery of mail is attained by means of the International Postal Union, founded at Bern, Switzerland, in 1874. The United States, the whole of Europe, Egypt, British India, China, and many other countries belong to it. It is this wonderful organization which gives us the opportunity of communicating by letter with all parts of the civilized world. The bare-footed Algerian postal facteur or the pig-tailed Chinese carrier is no less our postman than the man who blows the whistle at our door.

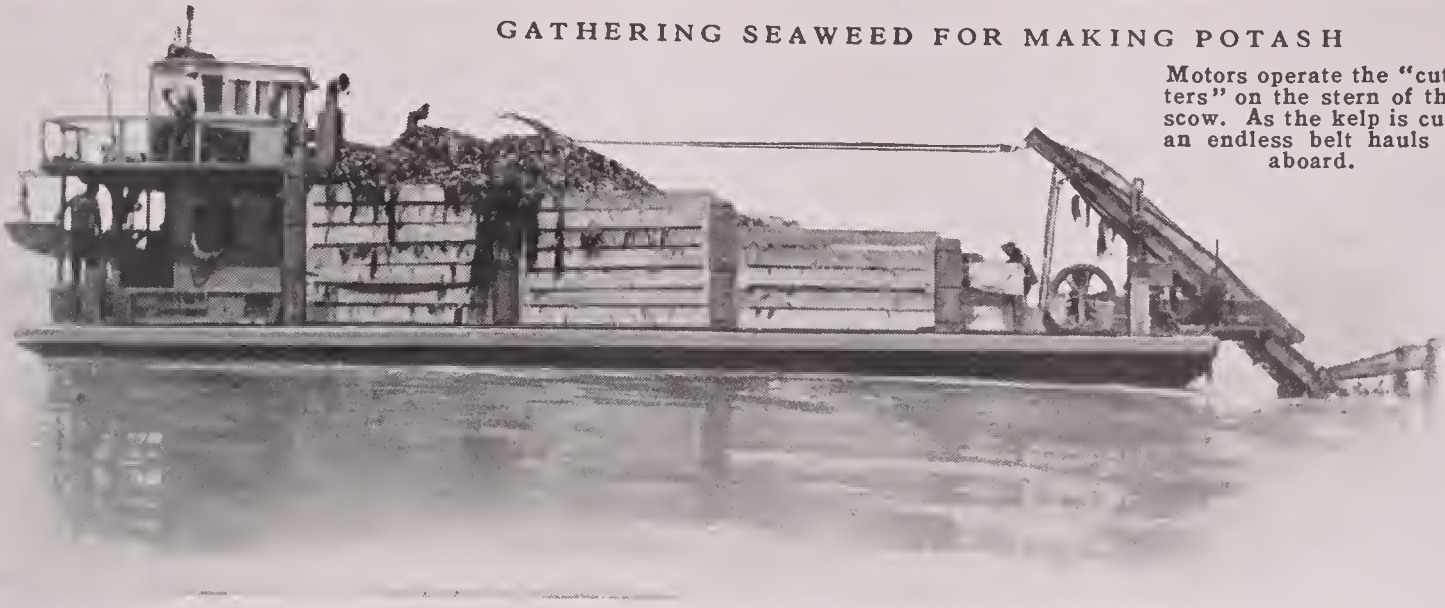
The Canadian postoffice system is organized on the same plan as that in the United States. There is free delivery in the larger cities, and rural delivery, begun in 1908, has developed rapidly.

There was a postal system in England as early as the time of Henry VIII, and the present English system is the outgrowth of that. The department is under the direction of the postmaster-general, who is a member of the Privy Council and the Cabinet. He is the only officer in the department who resigns on a change in government, all the others being under civil service. The systems of all other European countries are modeled after the British system. (*See also* Stamp; Transportation.)

POTAS'SIUM. "Germany can dictate which nations shall have food and which shall starve," boasted a great German chemist during the World War. His confidence—fortunately a mistaken one—was based not on German submarine ascendency, still less on any supply of food controlled by the Central Powers—they had not enough for themselves—but solely on the Stassfurt potash beds, in Prussian Saxony, the chief source of the world's commercial supply of this indispensable plant food. When the German supply was shut off, other sources were developed, though they fell far short of the demand. Thus the World War brought home the alarming fact that nature has stored available potash supplies at comparatively few points on the earth's surface, and that the world is largely dependent upon them for its food.

The metal potassium (chemical symbol, K), which gives us these important compounds, is one of the most crabbed, eccentric, and shyly retiring benefactors of the human race. We could get along without silver or gold; without potassium neither animals nor plants could live. Yet the metal potassium as such does not exist in nature. No human eye had beheld it until Sir Humphry Davy in 1807 drove it out of its hiding place in caustic potash, at

GATHERING SEAWEED FOR MAKING POTASH



Motors operate the "cutters" on the stern of the scow. As the kelp is cut, an endless belt hauls it aboard.

the point of the electric spark. Caustic potash, in fact, had been considered an element until then, and in ordinary speech we still refer to "potash compounds" rather than to "potassium compounds."

Potassium is one of that odd family of "alkali metals" which includes sodium and lithium, being (like both of these) soft, white, lighter than water, and never found uncombined in nature. When thrown on water it seizes furiously on the oxygen and part of the hydrogen, forming potassium hydroxide (caustic potash, KOH) and releases heat enough to burn the unappropriated hydrogen back to water again. During this process it dances raging and sputtering over the surface until the metal is all gone; it has been used in the past by clever whites to "make water burn" and thereby astonish ignorant savages. So frantically eager is the isolated metal to recombine that in laboratories it is kept smothered under a layer of petroleum to preserve it from oxidation.

Its many compounds have an important place in industry, though somewhat less important since the Leblanc and Solvay soda processes (*see* Soda) have made sodium cheaper than potassium and permitted sodium to be substituted for potassium in soap, glass, and other manufactures. They also have a tremendously important place in the nutrition of plants, which never accept substitutes. In experiments made in Maine the addition of a little "potash compound" to the soil doubled the potato yield. Cotton rust and declining yield are attributed to insufficient potash supply. When the soil is drained of potash compounds, crops starve, and so may those who depend on the crops.

Potash compounds are plentiful in nature. In fact, potassium ties sodium for sixth place in the list of elements arranged in order of abundance. But, unfortunately for the farmer, most of the potassium is locked up in insoluble silicates in the rocks, and the "weathering out" process which gradually releases them works too slowly to meet his needs. So the hungry world must turn to other sources for its potash.

COOKING OUT THE POTASH

After the kelp has been cut up into small bits and allowed to ferment, it is ready for the kilns, where it is heated to an extremely high temperature, and gradually purified until only pure white potash is left. Making potash from kelp is too expensive to be commercially important, but it proved valuable during the emergency of the World War.

The original source, on which the early glass and soap industries depended, was the lye from the leached ashes of land plants, boiled in a pot—hence the name "pot-ash." Obviously, this process tends rather to impoverish than to enrich the soil throughout the world. Some seaweeds, particularly the giant kelp of the Pacific coast, contain a comparatively large percentage of potassium salts, but the expense of extraction is great. The main commercial sources, therefore, are the salt beds of prehistoric seas or lakes, of which the largest and best known are the Stassfurt deposits in Germany. Extensive deposits also exist near Mülhausen in Alsace, and passed from German to French control at the end of the World War. The discovery of large deposits in Spain has recently been reported.

The potash famine during the World War caused the United States to search for possible domestic sources. Searles Lake, California, the salt lakes among the sand hills of Nebraska, the Salduro salt marsh in Utah, ancient lava in Wyoming, and the green sands of New Jersey, were among the most promising finds. Methods were also worked out for recovering the potash from the wastes from beet-sugar factories, from the dust from blast furnaces and cement mills, and other industrial wastes. The expense of recovering the potash, on which profitable development depends, varied from $40 to $120 a ton. The whole potash problem is one of cost. As soon as a cheap process of breaking up the insoluble potassium silicates of the rocks is discovered, or a method of separating out the potassium chloride and sulphate from the other salts in sea water, the problem of getting potash will cease to vex us.

Some of the more important potassium salts, with a few of their uses, are: potassium chloride (KCl,) the chief potassium fertilizer and the source from which other potassium compounds are made; potassium sulphate (K_2SO_4), fertilizer; potassium nitrate (KNO_3), manufacture of gunpowder and curing of meat; potassium bromide (KBr), photography; potassium cyanide (KCN), reduction of low-grade ores; potassium bichromate ($K_2Cr_2O_7$), tanning leather; potassium hydroxide or caustic potash (KOH), manufacture of soft soap; potassium carbonate (K_2CO_3), the true potash (the commercial name for the crude product is *pearl ash*), glass manufacture. The term "potash," now strictly applied to the carbonate but still loosely used in ordinary speech, was at one time given to the oxide, and the "potash content" of salts is still reckoned in terms of K_2O.

POTATO. When Cortez and Pizarro conquered Mexico and Peru for their gold and silver they found the natives cultivating and eating tubers from which our ordinary potatoes are descended. They carried back some of these to Spain and knowledge of the potato spread to Italy, Holland, and other countries. The doughty English sea-captain John Hawkins brought the first specimen from South America to England in 1563, and some 20 years later Sir Walter Raleigh showed some to Queen Elizabeth, after the return of the expeditions he had sent to Virginia.

But little did Sir Walter Raleigh think that these insignificant tubers would prove a greater boon to the world than all the gold and silver of America. The potato as developed by cultivation is one of the most prolific of food plants, producing more food per acre than any other crop. Yields of 200 to 300 bushels an acre are common, with fertilizers, and even 600 bushels an acre have been produced. The potato also had a wide range of cultivation, maturing farther north and at higher altitudes than any other important food crop except barley. Today the money value of the world's annual potato crop of nearly 6,000,000,000 bushels far exceeds that of the world's annual production of gold and silver. Nearly nine-tenths of the world crop is grown in Europe, because it meets the needs of the crowded continent as a human food and stock food. Northern France, Germany, Switzerland, Holland, Belgium, Denmark, Norway, Sweden, and Russia are all heavy growers and consumers of potatoes.

THE ANCESTOR OF THE POTATO

From the wild *Solanum tuberosum* all cultivated varieties of the potato are descended. The cultivated potato looks very much the same, except that the tuber is larger.

The cultivation of the potato has played an important part in the history of Europe. In certain parts of Germany it helped to check the famines caused by the Thirty Years' War. By 1688 it had become the staple food of the Irish peasantry, and the failure of the potato crop in 1845 and the resulting famine started the first great wave of Irish immigration to the United States. But in many places the introduction of this new food encountered prejudice and misrepresentation, for it was ignorantly said to be the cause of leprosy and many sorts of fevers. A learned Frenchman named Antoine Parmentier did much to dispel such prejudice through a series of books and pamphlets (1773–89) in which he urged its cultivation and use in France; and the French king Louis XVI wore the flowers of the plant in his buttonhole to popularize it. Frederick the Great of Prussia also championed the potato's cause.

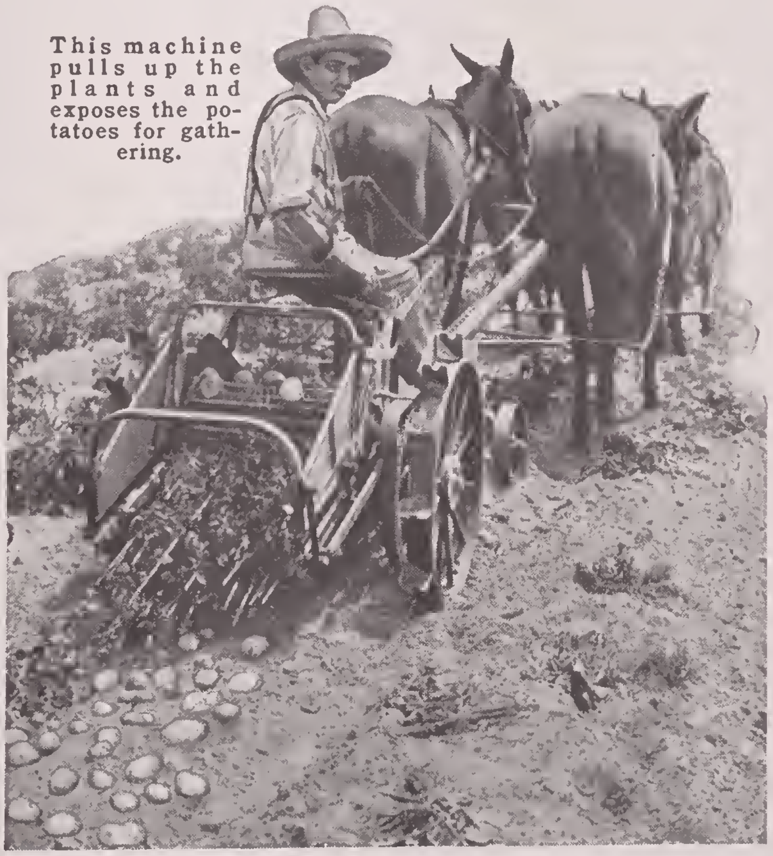
The potato is about three-fourths water, the remainder being starch, with small amounts of protein and fats. The proteins are in a layer next to the skin and may all be wasted by deep paring. The potato

IN THE LAND OF BIG POTATOES

Here is a potato field in bloom in a Montana valley. In preparing the ground for potato planting, the soil is plowed as deeply as possible without turning up the subsoil. The eyes or seed potatoes are usually planted in drills far enough apart to permit cultivation with horses, and 12 to 16 inches apart in the rows. The soil should be harrowed frequently until the plants are up, and then cultivated until the vines shade the ground.

is valued as a carbohydrate food, for the starch cells of the potato broken by cooking yield starch in an easily digested form. Potato starch (akin to corn starch) and potato flour are also manufactured products. Dehydrated or evaporated potatoes are a more concentrated food than rice. In Europe, especially in Germany, a variety of potato is used for making fuel alcohol as a substitute for gasoline and kerosene.

HARVESTING POTATOES IN FLORIDA



This machine pulls up the plants and exposes the potatoes for gathering.

The white or "Irish" potato (*Solanum tuberosum*) is a member of that large and interesting nightshade family (*Solanaceae*) which also gives us tobacco, poisons like belladonna, foods like the tomato, egg-plant, and red pepper, and flowers like the petunia. The poisonous principle found in the potato berries and leaves may develop in tubers exposed to the light, which usually turn green in this condition. The fleshy tuber is an underground stem in which the plant has stored up nutriment. The small purplish or white wheel-shaped flower of the potato sometimes develops into a soft green berry full of seed, but the cultivated potato produces fewer seed than the wild plants. Growing from seed seldom produces satisfactory results, but seedmen plant the seed in the hope of discovering new and desirable varieties, as did Burbank when he grew from seed the potato which bears his name. There are now perhaps a thousand well developed varieties, while at the time of the American Revolution there were only two, the red and the white. In growing potatoes, the most perfect tubers should be chosen as seed, cut in pieces and planted; the new plants grow from the eyes or buds on the cuttings.

In the United States the growing of early potatoes for northern markets is an important industry as far south as Florida and the Bermudas; but potatoes flourish best in climates which are just too cool for corn. There is a belt of 120,000,000 acres running from Newfoundland, maritime Canada, and New England, through New York, Pennsylvania, and the American and Canadian Lake region, and by way of the Yukon valley almost into the Arctic Circle, where potatoes have been found amazingly productive. The giant Idaho and Montana potatoes which often weigh several pounds are favorites for baking.

The sweet potato (*Ipomoea batatas*), although it also is a native of tropical America, belongs to a totally different botanical order from the white potato (*see* Sweet Potato).

POTATO-BUG. Civilization is responsible for the bad habits of this member of the beetle family. Five years before the Civil War, this insect was a harmless denizen of the western plains, where it fed on a weed called the sand-bur or buffalo bur. Its only name in those days was its scientific one, *Dorophora decemlineata*, the absence of a common name proving that it had never bothered anyone very much.

Unfortunately, the sand-bur was a sort of "country cousin" of the potato, and when the pioneer farmers of the West began planting potatoes, Dorophora discovered that the potato plant had a far more delicate flavor than its wild relative. Abandoning the sand-bur of the dry plains, the insect invaded fields and gardens. The new food agreed with it so that it multiplied with startling rapidity, soon winning the title of "potato-bug" or, more properly, "Colorado potato beetle."

Vast armies of these beetles began an eastward march. In 1859 they had reached Nebraska; in 1861 they were in Iowa; they crossed Iowa in four years; and jumped the Mississippi River in 1865. "They passed through Illinois," said one scientific observer, "traveling in many separate columns, just as Sherman marched to the sea."

By 1874 the potato beetle had reached the Atlantic seaboard, spreading north into Canada and south through Virginia. Today its territory includes all the United States east of the Rockies, with the exception of narrow strips along the Gulf of Mexico. It also found its way to Europe.

The adult potato-bug is a yellowish-brown beetle about three-eighths of an inch long and one-quarter of an inch wide, with ten black stripes running lengthwise down its high rounded back. It spends the winter in the ground, coming out at the first thaw and waiting for the appearance of the first potato sprouts, which it attacks with starving appetite. It begins to lay its orange-colored eggs almost immediately, on the under side of the young leaves. They hatch in about a week, producing dark red larvae or "slugs" of a shiny and disgusting appearance, which begin at once to devour the leaves at a great rate. In about 20 days the larvae reach full size, enter the pupa stage in the ground, and emerge as adult beetles about two weeks later. As each female lays 1,000 eggs or more and there are from two to three generations a summer, it is easy to see how the potato-bugs reach such enormous numbers. When potato plants are not available, they will often attack tomato plants, egg-plant, or even tobacco.

With proper care, the ravages of potato-bugs are not hard to check. Formerly these beetles and their slugs were picked or brushed off the vines by hand, but today the system of spraying the leaves with paris green or some other arsenic compound has proved the most rapid and effective way.

Just as the potato-bugs learned to eat potato vines, so many insects, birds, and other animals have learned to eat the potato-bug, since it migrated from the West. Certain species of lady-bugs devour the eggs and the young larvae in large numbers; while ground beetles, tiger-beetles, soldier bugs, robber-flies, and spiders also give man assistance in the battle. The chief bird enemies of the potato-bug are the grosbeaks, quail, robins, crows, grouse, and thrushes. The name "potato-bug" is sometimes applied also to a three-striped leaf beetle, and to certain blister beetles which occasionally do great damage to potato crops.

POTO'MAC RIVER. Placid and deliberate, bearing fortunes in weighty commodities—naval ordnance, building and paving stones, sand and gravel, oils and ice—the broad Potomac from Washington to Chesapeake Bay forgets its birth in the mountains. Perhaps too it forgets the old days when the white men first came—Capt. John Smith seeking a passage to the South Sea; later, merchant vessels from London bearing goods and gauds of all kinds to offer Virginia and Maryland planters for the strange new-fangled commodity, tobacco; still later, the great barge of young Mr. George Washington putting out from the Virginia shore to visit the Calverts in Maryland; and then all the tragedy of the war between North and South, whose boundary line was the same river.

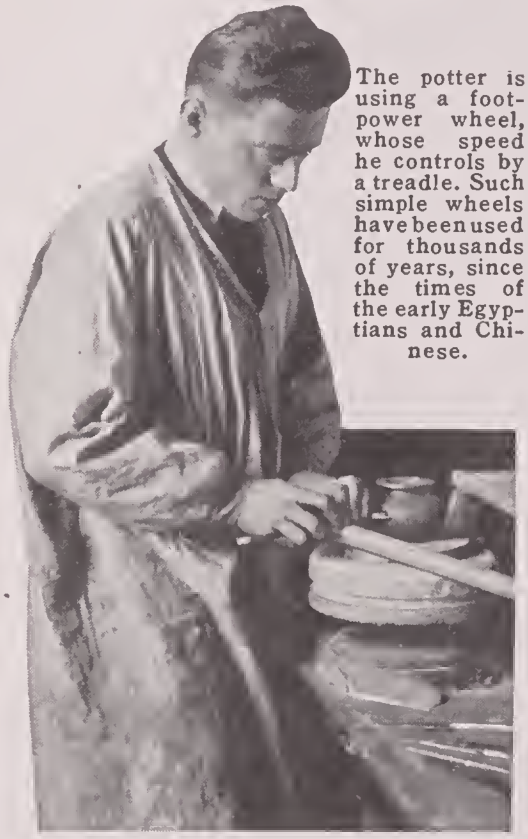
From its sources in the Alleghenies of Virginia and West Virginia to its mouth, the Potomac is about 450 miles long and for nearly its whole course a boundary between Maryland on the northeast and West Virginia and Virginia on the southwest. Its two branches, the north and the south, unite about 15 miles below Cumberland, Md. At Harper's Ferry the Shenandoah joins it in breaking a splendid gorge through the Blue Ridge. Later its other important tributary, the Monocacy, flows in from the Maryland side. Lower down, at the Great Falls, it tumbles over a six-staged terrace, once one of the wonders of America before Niagara Falls was easy to reach. The head of navigation is at Little Falls. At Washington, three and one-half miles farther down, the river is a mile wide, with a channel 20 feet deep. It is over seven miles wide where it enters Chesapeake Bay. Georgetown, D.C., and Alexandria, Va., are after Washington the most important cities on its banks. Washington's home and tomb at Mount Vernon and the national cemetery at Arlington are among the places of interest along the river.

The POTTER and HIS CLAY

POTTERY. The prettily decorated dishes on our tables, and the blue and white and yellow and white crockery utensils so necessary in our kitchens are among the most useful of the familiar things of everyday life. Because we are so accustomed to them we do not often stop to consider how they are made, yet the processes of manufacture as they are carried on in the gigantic factories of today are intensely interesting, and the history of pottery-making is one of the oldest and one of the most fascinating of industrial romances.

On the underside of our dishes we will find the name of the manufacturer and usually the place of manufacture. They may have been made in England, or are "true" porcelain from Limoges, France, or perhaps they come from Austria or Japan, where such a large proportion of the world's dishes are made. Or more probably they were made in the United States, where every year a greater amount of fine dinnerware is produced. The pottery industry is localized chiefly in New Jersey, New York, West Virginia, and Ohio, although there are smaller establishments in nearly all the states. These factories are turning out high-grade porcelain which compares favorably with any made in the world. There are a few American art potteries, where exquisite wares are produced, as the Roferno and Sicardo wares, found chiefly in private collections and museums, and Rookwood and Grueby varieties, all very beautiful.

TURNING A VASE



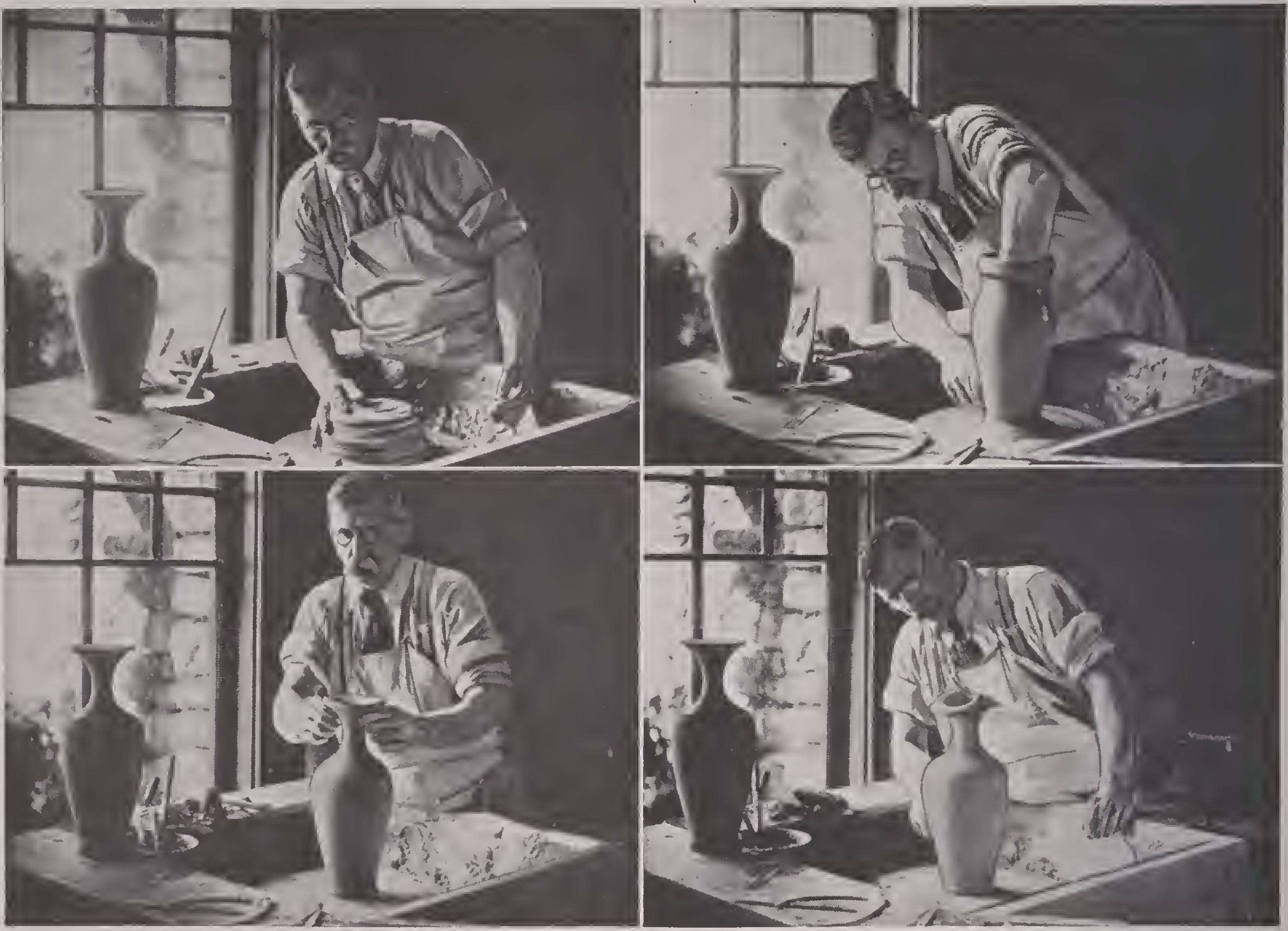
The potter is using a foot-power wheel, whose speed he controls by a treadle. Such simple wheels have been used for thousands of years, since the times of the early Egyptians and Chinese.

The potter's art, whether the object to be made is the expensive "true" porcelain or a cheap mixing bowl, depends on the fact that clay, mixed with water, can be molded into shape, and that by baking the clay mixture becomes hard. All pottery has two things in common, the body or main bulk, made from the clay foundation, and the glassy, water-proof glaze that coats the body. There are many kinds of clays and glazes, and upon the fineness of the materials used depends the grade of pottery produced.

The manufacturers keep their formulas secret. When the proper mixture for the body of the ware is made, heavy tanks with steel arms and teeth, known as "blungers," grind it up very thoroughly. Water is added and usually some oxide of cobalt is put in as a bleaching agent, just as the laundress puts bluing in the rinsing water to make the clothes whiter. This clay-filled liquid is strained through silk sieves or through fine meshes of copper wire, until it looks for all the world like thick cream. In one machine it is brought into contact with a series of magnets that extract any atoms of iron, for if any of these tiny fragments were left in, they would melt and discolor the pottery while it was being fired. Sometimes when not much care has been taken in preparing the clay, this happens, and often we see cheap china speckled with yellow or brownish stains. If there are bluish particles in the ware the cobalt has not been properly ground and sifted. Filter presses take this creamy mass and press out the water through canvas bags, leaving the smoothly mixed clay in putty-like cakes, which, for fine ware, go though a pugmill armed with steel knives to get rid of any air bubbles. Sometimes it is pounded and ground and washed still more until it seems as though there would be nothing left. It is this infinite care in the preparation of the clays that gave to China, Japan, and France their perfect results in china-making. When the clay or "slip" is ready for use, it can be stored away in a dark place for future use, and it improves with age. It is said that in China one generation prepares the "slip" for their sons, storing it away in underground cellars, while they use that which was prepared for them by their fathers.

The "slip" may be shaped in a number of ways—by throwing on a potter's wheel, by turning lathes, by shaping it with the hand over molds, by pressing it into plates or saucers or over flat ware, by casting in plaster-of-paris molds, or by packing the dry clay powder, only slightly moistened, into dies and compressing it under terrific pressure.

THE EVOLUTION OF A "THROWN" VASE



The potter who works with a simple hand wheel is called a "thrower." He first throws a lump of clay on the revolving wheel, and as it spins he fashions the vase with deft fingers, giving it first the general shape desired. He then smooths the inside by pressing a wet sponge against it, and lastly finishes the top by giving it a lip. This process is now used only for the finest ware.

The potter's wheel, the oldest of the potter's tools, is used for shaping deep circular vessels like cups and vases. It is simply a round piece of board set horizontally on top of a revolving spindle, the speed of which is controlled by the potter. On this sort of wheel the ancient Greeks fashioned their beautiful vases. The ancient Mexicans and Peruvians were skilled in its use, and it is employed to some extent today. The potter who is called the "thrower" throws a lump of clay on the wheel so that it sticks fast, revolving with the wheel. As the wheel spins he fashions the desired article with skilled hands. To the watcher it appears like a piece of magic, so quickly does the clay respond to his touch. He works up from the base, shaping the walls. His fingers, bent in a peculiar manner, touch the top of the bowl and it rises into a beautiful vase. Another touch and the top rolls over into a lip. If he is making a cup or mug, a handle is fashioned and fastened on with slip. When it is done, he draws a wire deftly between the board and the object and puts it away to dry. Pieces of pottery so made are known as thrown ware, and except in the finest porcelains and for some of the art potteries, the potter's wheel has been replaced by speedier methods.

Fragile cups and bowls and most of the exquisitely shaped figures and ornamental vases are cast in plaster-of-paris molds, which have been designed by sculptors. Into these molds the liquid slip is poured. The water in the slip filters through the mold, leaving a thin layer of clay behind. When this layer is thick enough all the remaining liquid slip is poured out, the clay lining soon becomes stiff, shrinking a little in the process, and the pieces of the mold are stripped off. If the outline is very irregular, the model is cut into several pieces, and from these pieces plaster molds are made. Sometimes, for very elaborately designed objects, more than a hundred sets of molds are necessary. "Egg-shell" china is made by casting.

Other Methods of Molding

Many pieces are fashioned on a "jigger," a revolving mold over which a sheet of clay is pressed and quickly shaped. After such a piece is dried the turner planes the surface to a smooth even thickness. Hollow ware—soup tureens, large covered dishes, and vases—are shaped by hand over or into molds the exact shape required. Usually each piece is made in several sections, and then the parts are pressed firmly together and held in place by leather thongs until dry, when the seams are smoothed away. Sometimes cheap pottery vases will have clearly defined seams which divide them into two parts. Plates and other flat ware are molded.

After the article is shaped and dried it is placed with many others in boxes of fire clay, called seggars, and arranged in a kiln. The entrance is bricked shut and the fires lighted. Gradually the heat is increased to nearly 3,000 degrees Fahrenheit and there it is kept for several hours while the particles of clay fuse together. Two or three days are required for the kiln to cool off; then the entrance is unbricked and the seggars taken out. The pottery is now known as biscuit ware, and has a dull rough surface, which can be marked with a lead pencil.

Putting the Glaze on the "Biscuit"

In another part of the factory the glaze has been made. Materials which make glass have been mixed together and baked into solid sheets, and these plates have been ground until they are pulverized. This flourlike mass is mixed with water to form the glaze "slip" or wash. Into this skilled workmen dip the biscuit ware so that every part is evenly covered. The pottery then goes to the glost kiln to be baked again, although at a lower temperature, until the glaze is fused, covering the pottery with its hard, glassy coating. Some earthenware is not dipped in glaze, but receives what is known as a salt glaze. When the heat of the kiln in which the pottery is being fired is cooled to a certain heat, the seggars are opened and some common salt (sodium chloride) is thrown in. The heat changes it to a vapor, and it divides into sodium and chlorine, and as the oven cools, the sodium settles on the articles in the form of a transparent glaze. Salt glazing is used largely in the heavy grayblue ware of cooking utensils and mugs.

Decorating is put on by hand or by transfer patterns, or by a combination of both. For flat ware printed designs are commonly used. The patterns in color are transferred to tissue paper from engraved plates, and this tissue paper is applied to the plate or saucer or platter and soaked off, leaving the design on the dish. Often, no doubt, you have seen a dish on which the decoration has not been put on quite evenly. Sometimes the decorations are put on the biscuit ware, when it is known as "under-glaze" decoration, and sometimes over the glaze, and often there is a combination of both. The various colors undergo great change in firing. Gold paint is dull and brownish before it is fired, black is blue, and pink is brown. Also the different colors require different temperatures to set them, and sometimes a vase has to be baked eight or nine times in the special kilns used for "over-glaze" colors before the design is complete.

The term "ceramics" was originally applied to pottery-making and clay-working industries, but now it is generally applied to all industries using earthy material and requiring the action of heat in the perfection of the product, and schools of ceramics have been established in a number of universities. The ceramics industries embrace the manufacture of all kinds of clay products, such as stoneware, china

HE REFUSED TO ACCEPT DEFEAT

One of the world's most inspiring stories of heroic persistence is that of Bernard Palissy, the great French potter of the 16th century. For years he experimented, trying to find the secret of a particular sort of glaze, until all his money was gone. Then he used his furniture, and finally the floor of his house, as fuel for the baking furnace. Here you see him, after one of his many failures, ready to begin all over again.

and porcelain, brick, tile, sewer pipe, terra cotta, portland cement, etc.; enameled metals and sanitary ware, all the many varieties of glass and glassware, etc. This classification will show that the ceramic field is a large one, and offers large possibilities for an enterprising boy.

Pottery the Oldest of Man's Arts

The making of pottery is the oldest of the arts known to man. In fact, when prehistoric man learned to mold crude vessels of clay and bake them hard in the fire he put savagery behind him and rose one long step in the slow advance to civilization. It was not until the historic age, however, that there is evidence that the potter's wheel was used alike by Mexicans, Peruvians, Egyptians, Greeks, Assyrians, Romans, Gauls, and Teutons. Much of our knowledge of the ancient peoples has come down to us through their clay work that has been preserved.

After the barbarian invasions the fine arts died in Rome and Greece. The ceramic work that was done in the Middle Ages was very crude, except that of the Moors in Spain. In the rebirth of pottery, Italy led. Among the most beautiful Italian wares was majolica, a decorated enameled pottery, usually made of coarse paste covered with an enamel containing tin. It is one of the most beautifully decorated potteries that was ever extensively made during the Christian era. A variety of majolica decorated in many colors and first made in Faenza, Italy, is known as *faience*, a name also given to several other varieties of highly decorated pottery.

The Dutch, too, played a part. As traders with China, who was also teaching Japan, they gained a knowledge of pottery which they combined with the knowledge of glazing they got from Italy. They learned how to make a blue color by using oxide of cobalt, and they learned a little about clay, and as a result they began to turn out a blue and white pottery known as Delft, from the Dutch city, at a much lower price than they could obtain Chinese wares. Earthenware dishes now began to replace wood, pewter, and tile even in humble homes.

Palissy and Wedgwood and Their Famous Work

About the middle of the 16th century, Bernard Palissy, a potter at Saintes, France, introduced new methods which made his name famous in the history of pottery-making. One day he saw a superb white enameled cup and he determined to discover how the glaze was put on. He worked years experimenting, spending every cent he had, and even chopping up the furniture in his house as fuel for the kiln. Although he never found the secret of the particular kind of enamel he was seeking, he did discover how to make beautifully colored enamels by coloring the glazes before putting them over the baked clay, instead of using a white enamel and then painting it. He made many beautiful vases and dishes decorated with this colored enamel.

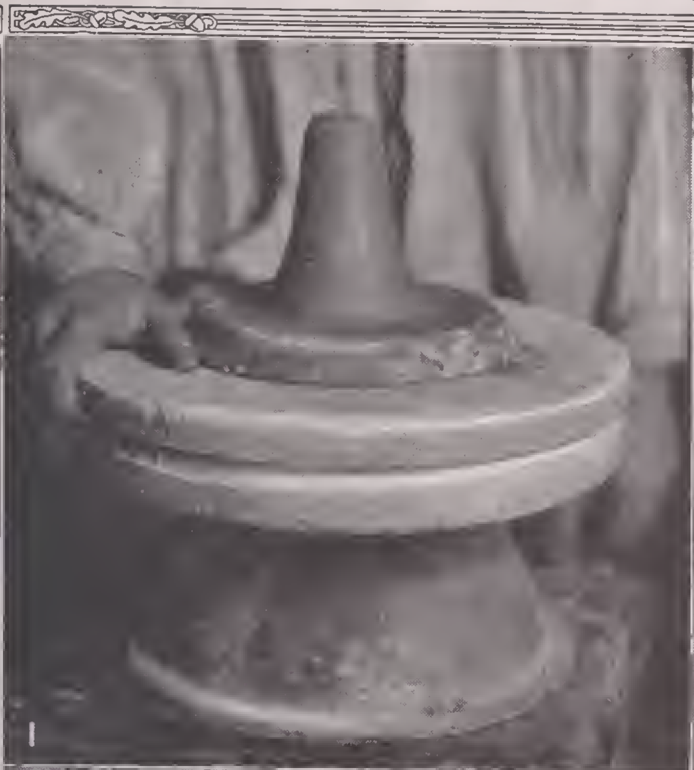
A PAINTER ORNAMENTING A ROOKWOOD VASE

Pottery may be ornamented either by painting with a brush or by transferring a printed pattern. The finer pieces are all decorated by hand, so that the artist has a chance to express himself almost as if he were working on canvas. Usually the design is painted on "biscuit" ware, before the glaze has been added, but it may also be put on afterwards.

Josiah Wedgwood (1730–1795) was England's greatest potter; in fact, he was one of the greatest potters that ever lived. His classic vases, ornamented by the sculptor Flaxman, are among the most beautiful pieces of pottery ever produced. Besides these beautiful pieces of art, he made dinnerware, called Queensware, Basaltes ware, mostly black, and encaustic painted wares. He first introduced cheap china in England and made it possible for everyone to have fresh, clean, and sanitary tableware. His name still sets a standard by which modern potters are measured.

In the middle of the last century, Henry Doulton, who also designed some beautiful pottery, devised a way to make glazed earthenware drain pipes. Thus for the first time in history it became possible to carry off the sewage of towns completely and remove one of the most fruitful causes of disease, and also to drain swamp lands and turn them into productive fields. Until the earthenware came into use the best drains were built of brick, which allowed sewage to seep through to pollute the soil. (*See also* Clay; Enameling; Porcelain and Chinaware.)

MOLDING BEAUTY OUT OF CLAY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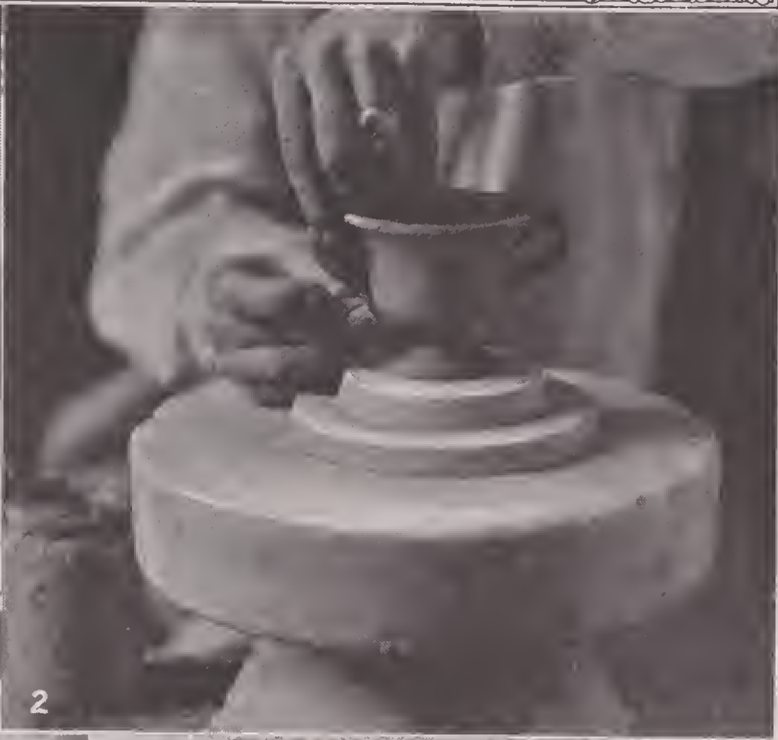
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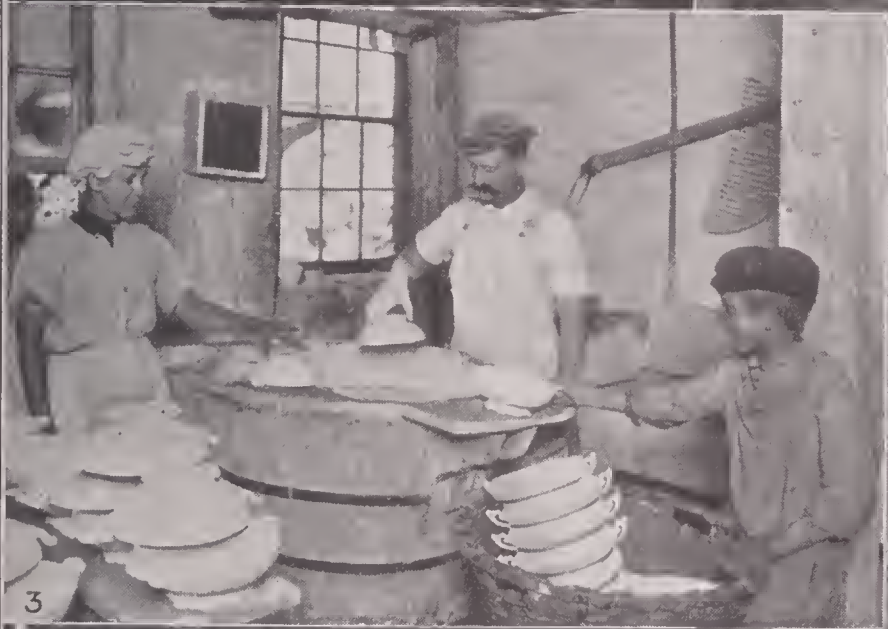
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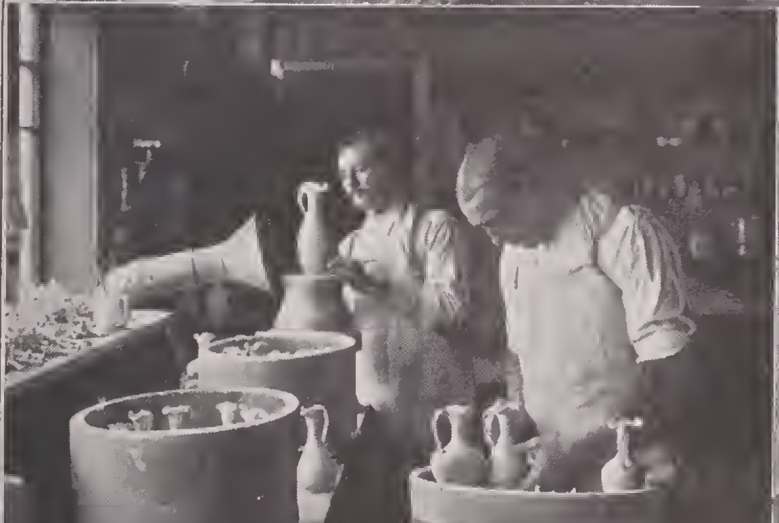
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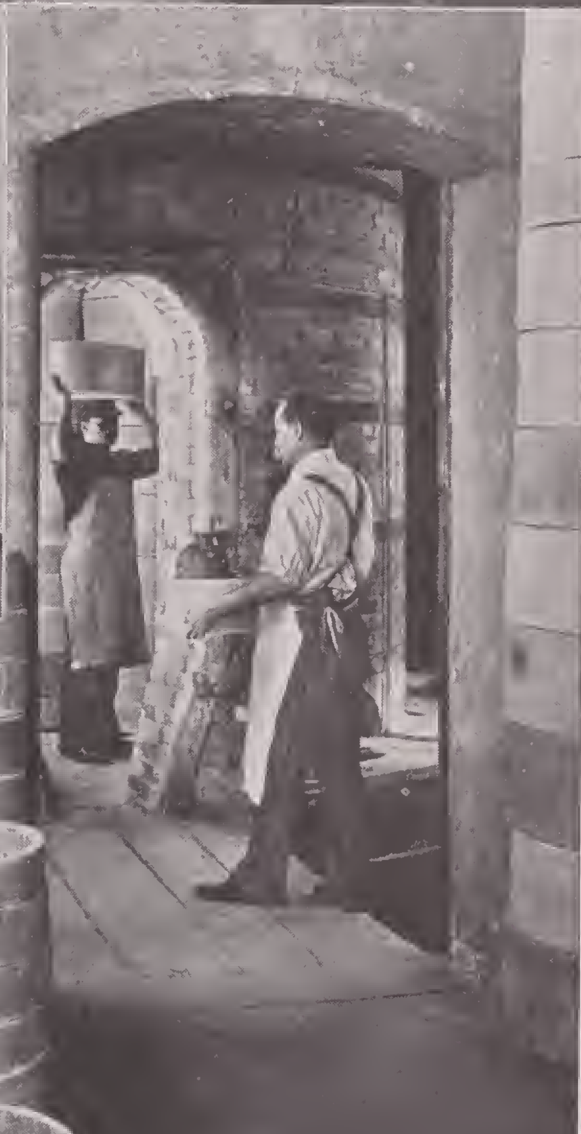
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The potter first fashions the ball of clay on the wheel into a cone (1). Then he inserts his thumb at the top to make the opening of the vessel, and gradually molds the plastic mass until the urn acquires shape (2). After the molding, pottery is given a first baking, from which it emerges as "biscuit" ware. Biscuit ware is glazed by dipping into a vat of liquid glaze (3), a process which requires great dexterity, for the dipper must hold the piece so that every part of the surface is covered with a thin coating. The ware is now ready for final firing. It is placed in earthenware pans called "seggars" or "saggars" (4), which are stacked high in the kiln (5). Finally the doorway of the kiln is bricked up. After 12 or 14 hours of intense heat, the glaze is melted and converted into transparent glass, and the ware is complete.

The HEN *and Her* GOLDEN EGGS

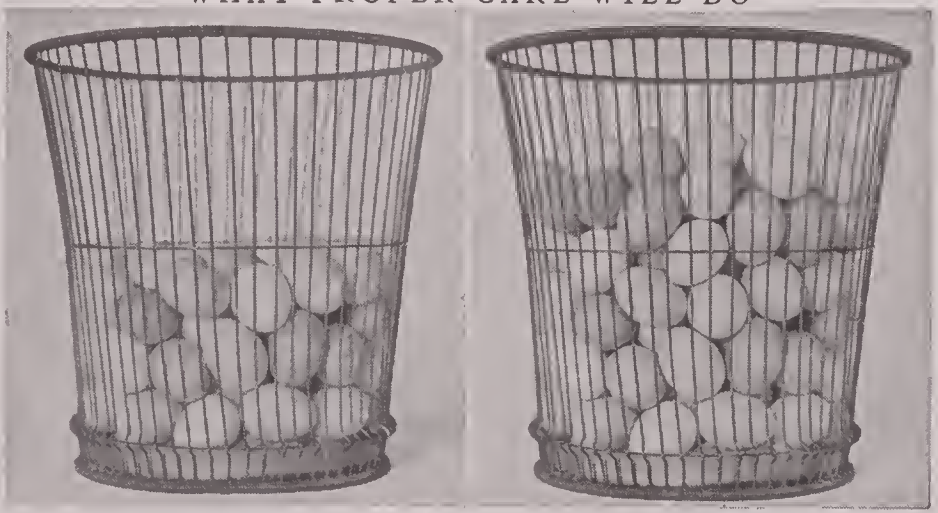
The Vast Wealth Produced by the Clucking Citizens of the Poultry Yard and Their Cousins, the Ducks, Geese, and Turkeys—Modern Methods of Chicken Raising and Some Egg-Laying Records

POULTRY. Every year the American hen more than pays for the cost of two Panama Canals. The value of poultry products in the United States normally exceeds that of the wheat crop, and all but a small proportion of this comes from the common domestic fowl, or chicken. Nearly one-half of this surprising sum is the value of the eggs produced. The hen's egg is the only one of commercial importance, for practically all the eggs of other domestic fowls are used for breeding purposes. Chickens also lead in the production of meat, for of every 100 fowls marketed, 96 are chickens, with only two turkeys, one duck, and one of the other fowls such as the goose and guinea-fowl.

Just out of the shell and looking for something to eat.

The importance of poultry as a factor in national wealth is not appreciated by most people, chiefly perhaps because chickens and eggs are generally by-products of the farm. Except on a few large poultry farms, they are generally raised by the farmer's wife, who may or may not be able to give them the same degree of attention that the farmer gives to the main crops. On this side of the Atlantic, little or no attempt has been made to organize the egg and poultry market, as has been done for instance, in Denmark, where egg producers are organized into a co-operative association which stamps every egg with an identification mark and holds each producer responsible for the quality of his eggs. The United States Department of Agriculture estimates that $50,000,000 a year is lost through bad methods of handling eggs, all the way from the farm to the market.

WHAT PROPER CARE WILL DO



According to the United States Department of Agriculture, the average production of eggs per hen is 60 a year; the basket at the left contains 60 eggs. With proper feed and care, a hen should average 120 eggs a year; the basket at the right gives you a picture of what this added production would mean.

More than 300,000,000 chickens are kept on the farms of the United States for breeding and laying, and more than 500,000,000 are sold every year for their meat. Chickens rank next to hogs and cattle as a source of food supply, for the amount of chicken meat marketed in the United States is one-fourth as much as beef, twice as much as veal, and four times as much as mutton and lamb; and the 1,900,000,000 dozen eggs produced in a year in this country more than double this weight of food to the credit of the hen. Millions of pounds of dressed poultry and eggs are placed in cold storage to insure a constant supply, especially during the winter months. Under the modern system of separating the roosters from the hens at the close of the breeding season, which is now practiced by most poultrymen, infertile eggs are produced which will keep a longer time. There are various methods for keeping eggs in the home, of which preserving in water glass is perhaps the simplest and most reliable. Eggs are one of the most nutritious of foods, entering into innumerable dainty dishes.

Cock Crows at the Dawn of History

When chickens were first tamed and raised by man is not known. Scientists believe that the wild fowls from which our tame breeds originated were natives of southwestern Asia, and that one of the species which contributed most largely to its ancestry is represented today by the red jungle fowl of India. This wild fowl is smaller than a prairie chicken, while a specimen of one of our meat varieties ready for the market sometimes weighs as much as 16 or 17 pounds. This is one of the many striking examples of what breeding and care will accomplish. Similarly in the production of eggs, while the wild fowl lays only one small setting of eggs a year, a flock of good layers today will average 120 eggs in a year and prize winners reach a mark well over 300. The 200-egg-a-year hen is now com-

IMPORTANT BREEDS OF POULTRY

Plymouth Rock

Wyandotte

Orpington

Rhode Island Red

mon. Improvement in weight of meat and number of eggs produced in any flock may be brought about by selecting only the best for breeding purposes, by keeping in a clean well-aired poultry house, and giving plenty of clean water and good feed, selected in proper variety for a balanced ration. The trap nest system, which enables the poultryman to keep an accurate egg-laying record of each hen, is a great aid in improving a flock for egg production. There are other methods too by which the poor layers can be eliminated and the eggs for setting selected from only the layers with the highest records.

The hen seldom exercises the art of the wild fowl in making her own nest for her eggs, but occasionally one desiring to sit will steal away to a nest hidden in a spot of her own choosing, and lay her one egg a day until there are as many in the nest as her feathers will cover. She will then patiently keep them warm with the heat of her body for 20 to 21 days and bring off her little brood of downy chicks.

How the Little Chicks Go to School

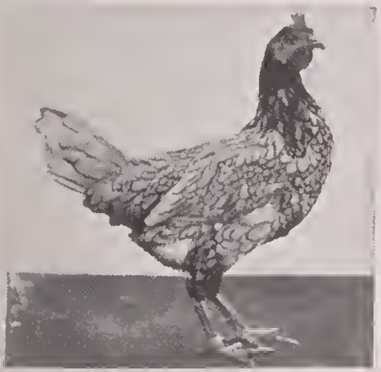
A mother hen exhibits a highly developed instinct in caring for her family. She teaches them by patient example how to drink, how and what to eat, and calls them with special fervor to enjoy a worm or tempting bug. If danger threatens, her prompt warning makes them hide under the nearest cover. When their old enemy the hawk sails menacingly overhead, his fleeting shadow on the ground is spied by some watchful chicken, and a warning sounds that sends even the grown-up members of the flock hurrying to cover. This instinctive fear was developed ages ago by the dangers of wild life, where hawk, fox, weasel, and other animals showed a marked fondness for fresh chicken; and after centuries in the domestic fold this instinct still is active.

The time of sitting and of caring for a brood is just so much time lost from laying, since the hen does not begin laying again until the young chickens are well able to care for themselves. For this reason, in a flock of any size, sitting is discouraged by the poultryman. The hens that show a desire to sit by staying on the nest, and clucking while off the nest, are cooped up to "break" them from sitting. In place of the sitting hens, with their tiny broods, we have the incubators in which eggs by the hundreds are placed for hatching. Artificial incubation is not a new practice, for the ancient Egyptians placed eggs in large brick ovens which held an even heat, hatching them in large numbers. The incubator is planned to imitate the natural conditions for hatch-

Cochin

Langshan

Brahma


Andalusian

Ancona

Minorca

Leghorn

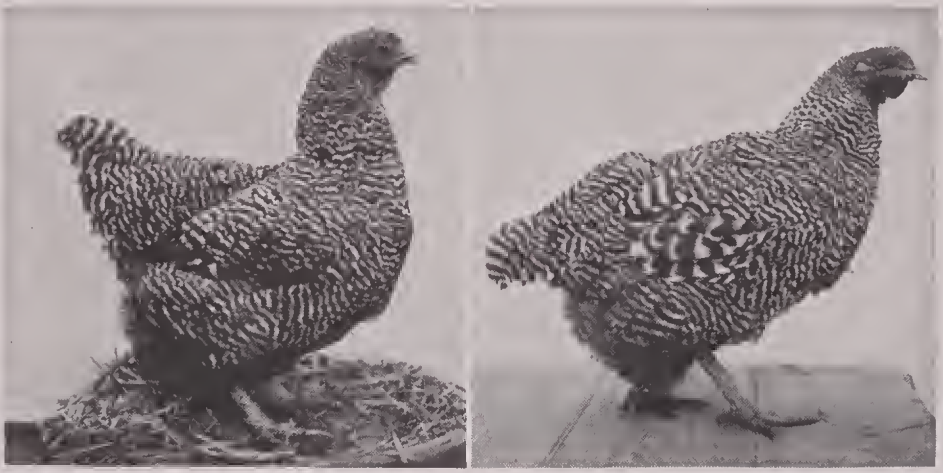
The upper row includes the breeds best for general purposes; they are good layers and attain medium size. The lower row includes the best layers, while the middle three are heavy meat breeds.

AN IDEAL ARRANGEMENT FOR LAYING HENS

This poultry raiser is evidently in business for the eggs he gets, not the meat. You can tell this from the clean neat arrangement of the hen house, which makes it certain that he will get all the eggs that are laid, and you can also tell from the characteristic leanness of the hen in his hand that she belongs to one of the "egg breeds." It is well known that hens allowed to run loose do not lay as well as hens that are confined, a lesson which this poultryman has taken to heart.

ing. A warm even temperature is provided by means of lamps automatically regulated, with a supply of fresh and slightly moist air. Since the mother carefully turns the eggs in her nest, so likewise the eggs in the incubator are turned over frequently during the period from the third to the eighth day. At the end of one week the eggs are tested and the infertile eggs, those which are not going to hatch, are removed. The test is made by the process known as "candling." The eggs are held before a light, and the infertile eggs appear clear and translucent. At the end of 14 days a second test is made to weed out those in which the germ has died. Finally at the end of the third week comes the time of greatest interest when first one and then many of the tiny bills hammer on prison walls and the downy yellow chicks make the best of their way out of their shell. From the incubator they are put in a warm brooder, where they live the life of pampered little orphans who are not allowed to venture out in the wet grass to hunt their food, but are fed and cared for scientifically until able to care for themselves.

HOW TO PICK A GOOD HEN



The hen at the left has the correct points. Its general carriage is erect. The neck is plump and square, the back flat and broad, the breast well filled, and the legs are of medium length. The bird at the right, on the contrary, will be a poor layer and will never be strong. The carriage is bad, due to the length of leg and the shallowness of the breast. The back, too, instead of being level, slopes downward, like stooped shoulders in human beings.

Poultry farms with extensive runs and scratching pens for winter feeding are operated on a larger scale in the United States than in any other country, but poultry-raising in some form is practically a universal industry. One feature of poultry-raising in European countries which seems odd to us is the common practice of pasturing their flocks. One person is often hired to take all the turkeys in a village out to forage for themselves, and the goose girl, or goose-herd, tends the geese while they feed. They also drive them along the road to market. In Italy, for example, it is a common sight to see large flocks of geese driven down from the Alps to the nearest market.

There are about 100 standard varieties of domestic chickens, falling into three main classes—Asiatic, Mediterranean, and American. The Asiatic breeds, which originated in China, are large and heavy, being valued as meat producers rather than as layers. The Mediterranean breeds, which come mostly from Italy and Spain, are smaller and noted chiefly for their laying qualities. The American breeds, all of which have been developed in little

THIS WAS TOO BIG A JOB FOR THE HENS

A modern incubator of this size will hatch more eggs in a season than a whole flock of hens. With the proper equipment it is not difficult to obtain at least 80 living chicks out of every 100 eggs. To get this result it is absolutely necessary that the temperature be constant, preferably about 100 degrees Fahrenheit; the heat should be controlled by some sort of mechanical regulator so that it will vary no more than one degree.

more than half a century, combine the qualities of both meat and egg production.

The best known breeds in the three classes are: (1) Asiatic: Brahmas, Cochins, Langshans; (2) Mediterranean: Leghorns, Minorcas, Spanish, Blue Andalusians, Anconas; (3) American: Plymouth Rocks, Wyandottes, Rhode Island Reds. England has also produced some distinctive breeds, especially famous for the excellent quality of their meat, including the well-known Orpingtons. Several varieties known as "games," including the Black-breasted Red Game—one of the oldest varieties of domestic fowl known—were developed originally for cock-fighting, but they now compare favorably in egg production with other classes, besides being excellent for meat.

Besides these breeds there are the ornamental varieties and others raised chiefly as curiosities, such as the white-crested black Polish fowl, with its odd white cap of feathers. The bantam breeds are interesting members of the poultry family, although there is no practical advantage in their dwarfed size and small eggs. Scientific name of domestic fowl, *Gallus domesticus*. (*See also* Duck; Goose; Turkey.)

PRAGUE (*prāg* or *präg*), CZECHO-SLOVAKIA. From the Vysehrad ("White-hill"), once the center of Prague, and now a melancholy waste of grass, crawling roads, and modern fortifications, one looks down upon a city of pointed spires, green domes, and red many-gabled roofs. Prague, the capital of the new republic of Czecho-Slovakia in the very center of Bohemia, is set like a gem among green fields and tree-covered hillsides, in a wide land of woods and meadows and streams.

Through it the Moldau (a tributary of the Elbe) wanders, cutting Prague in two,—broad and swift, hurrying along under its beautiful bridges. Long timber rafts, on which men run to and fro with tall poles, float slowly by. Boats cross from side to side.

In summer Prague's people are out of doors all day long—walking in the streets for the joy of being in them, and sitting under the trees on the islands in the river and in the gardens of many cafés and in the parks which lead to the country in every direction. They bring their books and their work with them; they bring little packets of sweets, and there is generally music in some corner near, the wild sweet music of Dvořák and Smetana.

The older parts of the town give one a strange sensation of being still in the Middle Ages, when one comes upon the great archways leading into narrow alleys or opening into dim courtyards. Twisting lanes lead from street to street. Restaurants show a glimmering light at the end of a long passage plunged in darkness. One gets glimpses of people moving across roughly paved squares or turning down a narrow passage under a low doorway

The Jewish quarter, even more medieval, is a medley of narrow streets and broad empty spaces, a circle of evil smells and half-naked children in the midst of shops of old clothes, and old houses with coats-of-arms over their doors and broken ornaments on their walls.

But there is a modern Prague, with tall characterless houses and fashionable shops, an atmosphere of life and bustle, as of a contented town life going steadily on about the business of one of Europe's most important manufacturing centers. Great establishments for the making of railway rolling stock are located here, sugar refineries, breweries, manufactories of chemicals; for Prague is both the rail and river-trade focus of all Bohemia, and the nation's trade in glass, porcelains, textiles of various sorts, and machinery clears through Prague.

War after war has devastated this city, spoiling it of much that was finest and most characteristic. The university, really two, one German and one Bohemian, has survived since its founding in 1384. Since the World War Prague, the city of John Huss and of the Czech's dreams and memories, emerges from the centuries of Austrian domination as a reality. The war's heritage of hard problems have here been solved in better fashion than anywhere else in Eastern Europe; and the continued greatness of Prague seems assured. The population is about 600,000, less than one-fifth being Germans.

PRAIRIE-DOG. A group of little hillocks spread over the landscape; a plump little animal or two seated upon each hillock curiously scrutinizing the approaching stranger—that is the visitor's first picture of a prairie-dog "town." As he draws nearer, the animals pop into the hillocks with lightning speed; then when he has passed they cautiously emerge again to watch him.

The hillocks, spread so picturesquely over the plain, are entrances to burrows, which extend sharply down into the ground sometimes a dozen feet or more. They form a secure shelter to keep out the water in a heavy rainfall. From the bottom of the steep shaft extends a winding horizontal tunnel, which sometimes ends in a room for the storage of fodder or the accommodation of the young prairie-dogs. In the summer the prairie-dogs eat grass, alfalfa, and other plants and store food for the winter, when they retire to the comfortable depths of their homes to sleep the months away.

These colonies are very common on the western plains in Montana, Wyoming, western Kansas, Texas, New Mexico, and Arizona and on the slopes of the Rockies in Utah and Colorado. The burrows are often frequented by weasels, badgers, and snakes which prey on their hosts and keep down their numbers. With the general settlement of the country came the destruction of these enemies, and as the cultivation and irrigation of hitherto arid country gave the prairie-dog a plentiful supply of food they increased prodigiously until at the beginning of the present century they were a great nuisance to the farmer and ranchman. In western Texas one continuous colony is about 250 miles long and 100 miles wide. It is estimated that in the entire state of Texas 90,000 square miles are occupied by prairie-dogs and the number of these animals within this area runs into hundreds of millions. One square mile in eastern Arizona by actual count contains 7,200 burrows.

The prairie-dog is in no sense a dog, but belongs to the order of gnawing animals. Its bark, from which it gains its name, is short and sharp, like a puppy's.

Like its near relative the groundhog or woodchuck, the prairie-dog is a true marmot. The marmots and the ground-squirrels make up the large subfamily of the squirrel family called the *Arctomyinae*. All the members of this subfamily are distinguished from the true squirrels by having proportionately shorter and stouter bodies and shorter tails. There are many varieties of marmots, differing widely in size and color. In Europe they range through the Alps through Asia north of and including the inner ranges of the Himalayas. The best known European variety is the Alpine marmot (*Arctomys marmotta*).

Scientific name of prairie-dog, *Cynomys ludovicianus;* length from 14 to 17 inches; weight from 1 to more than 3 pounds; hair pale chestnut, lighter beneath. Found only in the interior of North America.

PREPOSITION. The meaning of nouns and verbs is rendered clearer and more precise by the use not only of adjectives and adverbs but also of certain groups of words performing the same service. When we say "a girl with yellow hair" it is evident that the group of words "with yellow hair" is equivalent to the adjective "yellow-haired." In the sentence "The foe fled with haste," the group of words "with haste" clearly modifies the meaning of the verb "fled" and is equivalent to the adverb "hastily." We call such groups of words *prepositional phrases*. If they modify nouns and pronouns, as adjectives do, they are called *adjective* phrases; if they modify verbs, as adverbs do, they are called *adverbial* phrases.

If you examine a number of such phrases you will find that they all consist of two principal elements; a substantive and an introductory word, usually a short one, like *in*, *for*, *by*, *with*, *against*, etc. This introductory word is called a *preposition*, from the Latin *praepositum* meaning "placed before," because it is usually placed before the substantive it introduces; or, as we say, *governs*. The duty of the preposition is to show the relation between the word it governs and the word the phrase modifies. Thus, in the sentence, "It will rain before tomorrow," the preposition *before* shows a relation of time between the verb *will rain* and the noun *tomorrow*.

Though there are comparatively few prepositions, they express a great variety of relationship, such as time, place, manner, means, agency, cause, accompaniment, opposition, source, destination, etc. The same preposition may express several of these relations in different uses; as *with* a hammer (*means*), *with* speed (*manner*), *with* me (accompaniment).

Misuse of these important little words is a common error in speaking and writing. You will often hear careless speakers say, "I went *in* the house," for "*into* the house"; "I got the book *off of* him," for "*from* him"; "He is staying *over to* my house," for "*at* my house"; "She wasn't *to* home," for "*at* home".

The PRESIDENTS *of the* UNITED STATES

Name	Dates of Administration	Age at Inauguration	Party	State from which Elected	Occupation
1. **George Washington**	1789–1797	57	Federalist	Virginia	Planter
2. **John Adams**	1797–1801	61	Federalist	Massachusetts	Lawyer
3. **Thomas Jefferson**	1801–1809	57	Democratic-Republican	Virginia	Planter
4. **James Madison**	1809–1817	57	Democratic-Republican	Virginia	Public official
5. **James Monroe**	1817–1825	58	Democratic-Republican	Virginia	Lawyer
6. **John Quincy Adams**	1825–1829	57	Democratic-Republican	Massachusetts	Lawyer
7. **Andrew Jackson**	1829–1837	61	Democrat	Tennessee	Lawyer
8. **Martin Van Buren**	1837–1841	54	Democrat	New York	Lawyer
9. **William Henry Harrison (died one month after inauguration)**	1841–1841	68	Whig	Ohio	Farmer
10. **John Tyler (became president at death of Harrison)**	1841–1845	51	Whig	Virginia	Lawyer
11. **James Knox Polk**	1845–1849	49	Democrat	Tennessee	Lawyer
12. **Zachary Taylor (died 16 months after inauguration)**	1849–1850	64	Whig	Louisiana	Soldier
13. **Millard Fillmore (became president at death of Taylor)**	1850–1853	50	Whig	New York	Lawyer
14. **Franklin Pierce**	1853–1857	48	Democrat	New Hampshire	Lawyer
15. **James Buchanan**	1857–1861	65	Democrat	Pennsylvania	Lawyer
16. **Abraham Lincoln (died from assassin's bullet one month after second inauguration)**	1861–1865	52	Republican	Illinois	Lawyer
17. **Andrew Johnson (became president at death of Lincoln)**	1865–1869	56	Republican	Tennessee	Tailor
18. **Ulysses Simpson Grant**	1869–1877	46	Republican	Illinois	Soldier
19. **Rutherford Birchard Hayes**	1877–1881	54	Republican	Ohio	Lawyer
20. **James Abram Garfield (died from assassin's bullet four months after inauguration)**	1881–1881	49	Republican	Ohio	Lawyer
21. **Chester Alan Arthur (became president at death of Garfield)**	1881–1885	50	Republican	New York	Lawyer
22. **Grover Cleveland**	1885–1889	47	Democrat	New York	Lawyer
23. **Benjamin Harrison**	1889–1893	55	Republican	Indiana	Lawyer
24. **Grover Cleveland (second term)**	1893–1897	55	Democrat	New York	Lawyer
25. **William McKinley (died from assassin's bullet six months after second inauguration)**	1897–1901	54	Republican	Ohio	Lawyer
26. **Theodore Roosevelt (became president at death of McKinley; reëlected 1904)**	1901–1909	42	Republican	New York	Public official
27. **William Howard Taft**	1909–1913	51	Republican	Ohio	Lawyer
28. **Woodrow Wilson**	1913–1921	56	Democrat	New Jersey	Educator
29. **Warren Gamaliel Harding**	1921–	56	Republican	Ohio	Editor

PRESIDENT OF THE UNITED STATES. By virtue of his office, the president of the United States is one of the foremost rulers of the world. By the provision of the Constitution no person except a natural-born citizen, over 35 years of age, and for 14 years a resident within the United States, may be elected to this office. His term is four years. There is no limit set by law to the number of times a president may be reëlected, but the example set by Washington and Jefferson created a tradition against a third term, and popular prejudice so far has refused to grant the presidency to anyone for more than two terms, or eight years in all.

Really the president attains his position by vote of the people of the United States, who every four years fight the world's greatest political battle for his selection. But in form he is chosen by a group of persons known collectively as the electoral college, who in turn are elected by the people. These presidential electors are chosen by states, each state having the same number as it has senators and representatives in Congress. In the early days, before party organizations and party nominations were so well established, the electors actually chose the president and vice-president, as the Constitution clearly intended that they should. But now custom has become so strong that no elector would dare to vote for a candidate other than the one nominated by the party to which he owes his own election. So, as soon as the electors are chosen—on the Tuesday after the first Monday in November of the years which are divisible by four—everyone knows who will be the next president, although he is not formally chosen by the electoral college until some weeks later. The electors meet in their respective states on the second Monday in January, and cast their votes. The votes are then opened and counted by both houses of Congress, in joint session, on the second Wednesday of February. If no candidate has a majority of all the votes, the House of Representatives chooses the president by ballot from the three who have the highest number of votes, each state having one vote; the vice-president is similarly chosen by the Senate.

The president now receives a salary of $75,000 a year. This is an amount much smaller than that paid to the rulers of other great nations, but he has some allowances besides this. He is given $25,000 a year for traveling expenses, the use of the White House as his official residence, and about $86,000 a year for the upkeep of the building and grounds.

At the time of his inauguration, on March 4, the president assumes heavy responsibilities and duties, but he has given to him also great powers to perform these duties. In order that he may see that the Constitution, laws and treaties, and decisions of the Federal courts are properly enforced, he has power—with the "advice and consent" of the Senate—to appoint and dismiss thousands of officers, to command the army and navy, to call extra sessions of Congress, to recommend to Congress the passage of proper laws, and to veto bills passed by Congress which he thinks will be harmful to the country. His veto, however, may be overridden by a two-thirds vote of each house of Congress.

Naturally the president cannot perform all of these duties without assistance. His chief advisors and assistants are the heads of the great departments of government, some ten in number, who together make up the Cabinet. These Cabinet officers are appointed by the president, though the Senate must consent to their appointment, and they may be removed by the president at any time. As a usual thing, of course, they are all of the same political party as the president. (*See* Cabinet.)

It would be a serious danger to the country for the important office of president ever to become vacant, consequently the Constitution provides that if the person elected president should be removed by death or otherwise, his place shall be filled by the vice-president. Congress has further provided that if neither of these men can act as chief executive, that the office shall then go to the cabinet members, in an order fixed by law, the secretary of state heading the list. No situation, however, has ever arisen in which it has been necessary to use the provisions of this law.

So long as a person holds the presidential office he cannot, according to law, be arrested for any offense he may commit. The president can be removed from his office only by the process of impeachment, in which the House of Representatives makes the charges, and the Senate as a judicial body hears and decides the case (*see* Impeachment). The only time that impeachment charges were ever voted against a president—in the case of President Johnson—the two-thirds majority vote for conviction could not be obtained (*see* Johnson, Andrew). After a president leaves office and becomes again a private citizen he may be punished for any crime he has committed during his term.

PRETENDER. Two princes especially of the exiled house of Stuart have been styled "Pretender" in English and Scottish history. James Stuart, the Old Pretender (1688–1766), the son of James II and Mary of Modena, was born on June 10, 1688. The opponents to King James believed that the babe was not the son of the king and queen, but that he was smuggled into the queen's apartments in a warming pan. Resentment at such a fraud was one of the causes which led them, with the aid of William III of Orange, to drive James II from the throne. (*See* James, Kings of England.) When James II died at the court of St. Germain, in France, in 1701, a French herald proclaimed the 13-year-old boy in Latin, French, and English, "James III, king of England and Scotland." Although the boy was received at the French court with all the honors which his father had received before him, and in England and Scotland a few nobles remained faithful to him, his life was one of constant expectation and disappointment. His attempt to invade Scotland in 1715, with French aid, proved a failure. If he had been willing to abandon the Catholic faith in which he had been reared, and accept the faith of the Church of England, he could undoubtedly have gained the throne. He died at Rome in 1766.

His son Charles Edward, the Young Pretender (1720–1788), was a more dashing and attractive character than his solemn father. His invasion of Scotland in 1745 aroused great enthusiasm among the Highlanders, and it is from that event that we have the old song—

> Oh, Charlie he's a fine young man,
> And Charlie he's a dandy;
> And Charlie he will kiss the girls
> Whenever it comes handy!

Other "Jacobites" (as the Stuart adherents were called from the Latin *Jacobus*, "James") joined him, and he even reached Derby, in England, 130 miles from London. But there his forces were obliged to turn back and were soon scattered.

The Duke of Cumberland followed the Pretender's Highlanders into Scotland and inflicted a terrible and bloody defeat upon them in the battle of Culloden Moor, about five miles from Inverness. The relentless cruelty with which Cumberland slaughtered the helpless fugitives and wounded gained him the name of the Butcher.

Prince Charlie's own escape presents one of the most thrilling stories in history. When capture seemed inevitable he was rescued by a brave Scottish girl, Flora Macdonald, who took him with her, in the disguise of a woman, past the line of eager sentinels. A reward of $150,000 was placed on his head, and hundreds of persons were in the secret of his whereabouts; but none betrayed him. After five months' wandering about western Scotland, he reached a French vessel and escaped to the continent.

This was the last real attempt to restore the Stuart line to the English and Scottish thrones, from which it was deposed in 1688.

PRIMARY ELECTIONS. For many years the "party boss" and the party machine selected the candidates for office. But at the beginning of the 20th century there was a revolt against party politics, and the direct primary was one of the results. The aim of the primary or "nominating" elections is to give the people a fair chance to select the candidates between whom the final choice must be made.

More than 30 states have adopted the primary to nominate local, county, and state officers, and representatives in Congress, and in some states it is used for senators and to express a preference for presidential candidates. The details of the system vary in different states, but there are some points common to all. For instance the different parties hold primaries at the same time and place. Names of candidates are put on the ballot by petition, and are printed in alphabetical order. The candidate in each party who receives the highest number of votes is nominated, and his name goes on the ballot in the election which follows.

Some primaries are "open" and some are "closed." At the latter only members of the party holding the primary can vote. But who are members? This is decided differently in different states. Sometimes the *intention* to support the nominees of a party at the next election determines party membership. Or it may be decided by the person's vote at the last election, or by his answering questions which the party prescribes. At the open primary everyone is given a ballot for each party; he votes the one he wishes and deposits the others in a box for unmarked ballots.

For local elections there is often a non-partisan primary. At this the names of all candidates are printed on one ballot, with no party distinctions, and the two persons receiving the most votes for each office become the candidates for that office.

The direct primary has not proved a panacea for all the ills of party politics, but it offers an opportunity to defeat a conspicuously unfit candidate or to nominate one conspicuously well fitted. It is an opportunity, not a cure, and it places the responsibility for securing good candidates upon the voter.

PRIMROSE. The yellow English primrose is usually associated with Lord Beaconsfield, for he loved this dainty flower above all others. At his death a wreath of its blossoms was sent by Queen Victoria to be placed upon his coffin, and the primrose has since become the emblem of the British Conservative party. Springing from amid the broad hairy leaves, the delicately fragrant yellow blossoms grow singly on long stems, blossoming during April and May. Many varieties of the primrose are in cultivation both in Europe and in this country, their blossoms ranging from bright yellow to the deepest purple. Altogether the primrose genus contains about 150 species, 13 of which are natives of North America.

Scientific name of the common English primrose, *Primula vulgaris*. Flowers pale yellow, an inch across, growing on separate stalks as long as the leaves; calyx tubular, 5-toothed; corolla salver-shaped, 5-lobed; 5 stamens; leaves tufted and wrinkled.

PRINCE EDWARD ISLAND, CANADA. You could put this little island province 300 times over into its huge neighbor, Quebec; yet it remains an independent unit of the Dominion, admitted in 1873. Its greatest breadth is only 34 miles and its length is about 110, making an area of 2,184 square miles. It is by far the smallest of the Canadian provinces, though the most densely populated.

The island is crescent-shaped, lying in the curve of the great semicircle formed by New Brunswick and the peninsula of Nova Scotia. Protected by the sand dunes which encircle the low-lying coast, practically every acre is fertile land, giving it the name of "the Garden of the Gulf." The prosperous farming population raises large crops of oats, potatoes, and turnips. Cattle, sheep, and hogs flourish, and the pork-packing and dairying industries are highly profitable. Fishing for lobsters, oysters, herring, cod, and mackerel is, next to agriculture, the most productive calling. A recent and flourishing industry is the breeding of the silver fox on special ranches.

Railway car ferries plying across the narrow Northumberland strait connect the island with the mainland. Charlottetown, the capital (population, about 12,000), is situated on an excellent harbor and absorbs most of the trade of the province. From June to September Prince Edward Island is a paradise for tourists, who come to enjoy the delightfully mild climate. The island is served by an excellent railway system, and has fine primary and secondary schools.

Jacques Cartier, the French explorer, first sighted this island in 1534. Under the name of the Isle of St. Jean, it remained a French possession until captured by the British in 1758. In 1798 it received its present name in honor of Edward Augustus, the father of Queen Victoria. Population, about 95,000.

How WORDS MARCHED *into* PRINT

First of All, the Letters that Form Them Had to be Cast in Movable Type So that They Could "Line Up" Properly, Like Well-Trained Soldiers—History of the Art that Serves All Arts

PRINTING. Ages ago the Chinese learned that by carving letters or designs in relief on blocks of wood these could be inked and stamped or printed in reverse on sheets of paper. And in Europe also, about the year 1350, "block books" of a few rude printed pages each began to be made (*see* Books and Book-Making). But this is not what we mean today by printing. As we use the term it means printing from *movable types*, which can quickly and easily be combined and recombined over and over again. There is all the difference in the world between the slow and clumsy "block-book" work and modern printing.

In order that we might have the art of printing—rightly called "the art preservative of all arts"—several things were necessary. First, some way must be found of making types of exactly the same thickness from the bottom of the letters to the top, so that they could be "locked up" without "pieing," as the printer calls it when the type falls out and spills. Second, the types must be of exactly the same height, or some would print and others not when the paper was pressed down upon the "form." And third, there was need of a cheap and rapid means of accurately reproducing each of the characters, so that the printer might have enough *e*'s and *a*'s and *h*'s and all the other letters which he uses in printing a book.

Only one way has ever been found for satisfying these three requirements, and that is by casting the type in metal in uniform molds. So the invention of the *type-mold* is really the invention of printing. And this invention clearly belongs to Johann Gutenberg, who was born in the great cathedral city of Mainz, Germany, of a good family, about the year 1400.

And This World Benefactor Died Poor

For something like 20 years Gutenberg was engaged in secret researches, in Strasbourg and in Mainz, and much of this time he was probably engaged on his great invention. Many things had to be settled—the "matrixes" for making the "faces" of the types; the mold for the "body"; the right composition for the type-metal; and the method of casting. And after all these questions were solved, there remained the construction of the press itself, the making of paper, and the details of printing and binding.

Types and presses no doubt were the "tools" to make which Gutenberg borrowed money from Johann Fust (or Faust) of Mainz in 1450. When he proved unable to repay the money promptly, Fust brought suit and obtained possession of Gutenberg's types and presses (1455) with which he himself then set up as a printer. As in the case of so many later inventors, others reaped most of the profit of Gutenberg's labors, and he died in comparative poverty in 1468.

Gutenberg's method of casting type seems to have been very much like that which is still used. First, a "punch" of hard steel was made with the letter in relief in the end. With this a "matrix" for the face of the letter was punched in a bar of soft metal. This matrix was then used to close one end of the "mold" for the type body, while the molten mixture of lead and alloys was poured in at the other end (*see* Type). The faces of the early types were made to resemble closely the lettering used in hand-written books.

The first complete book printed from type was the Latin Bible—known as the "Mazarin" Bible, or Bible of 42 lines (to the page)—and it was finished in 1456. This is supposed to have been printed by Gutenberg, but it may have been printed by Fust or one of his assistants.

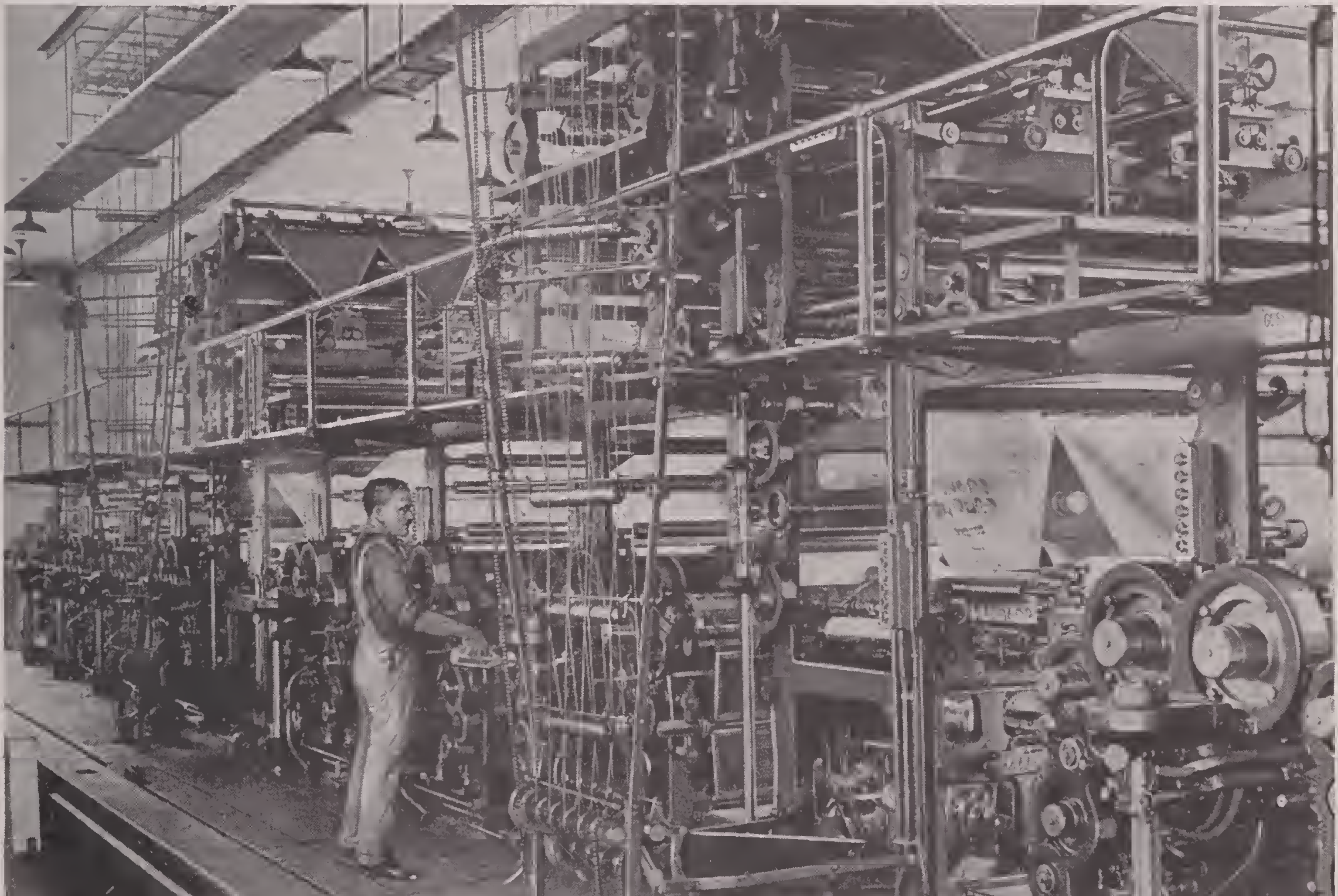
Rival Claimants to Gutenberg's Fame

The whole subject of the inventing and early history of printing is full of disputes. The honor is claimed for a dozen or more persons, in as many cities, the chief rival to Gutenberg being Laurens Coster of Haarlem (Holland). But the best authorities give Gutenberg the credit. In 1462 the city of Mainz was captured and sacked, and its printers were dispersed to different German cities. Within 50 years printers had established themselves in more than 200 places in Europe, and books and leaflets were being turned out at a very rapid rate. The effect was greatly to cheapen books and spread broadcast culture and knowledge. Printing proved an indispensable aid to the religious Reformation, and to the rapid intellectual development of more modern times.

The early printing presses were rude wooden affairs in which a "platen" was screwed down with levers so as to press a moist sheet of paper against an inked "form" of type. The type was inked by patting it with stuffed feather balls daubed in thick printer's ink. This was a very slow and unsatisfactory process. Later hand presses operated by a lever were invented, similar to the "Franklin" and "Washington" hand presses which were used in country newspaper offices until comparatively recent years, and inking by means of gelatine rollers was introduced. Rotary "cylinder" presses, operated by steam power, were first used in England, about 1814. The greatest marvel of all are the modern "perfecting" presses, which print, fold, and paste whole newspapers and magazines from continuous rolls of paper, at the rate of 100,000 copies or more an hour. They are a development of American inventive ingenuity, largely that of R. M. Hoe, of New York, beginning about 1850. Few machines are more complicated and costly than these giants.

GOING TO PRESS IN THE OLD DAYS AND IN THE NEW

What a contrast between the primitive affair shown in the upper picture and the great modern high-speed press in the picture below! Gutenberg is showing one of the sheets from his press to Johann Fust, the goldsmith who supplied him with money to carry on his work. This simple type of machine, which was merely a development of the old-fashioned cider or cheese press, remained in use without improvement for a century and a half.



The newspapers and magazines of today with their enormous circulations would be impossible without the aid of such mechanical giants as this. A "rotary perfecting" press of this character will print 36,000 twenty-four page newspapers or sections of newspapers an hour, all cut and folded ready for delivery. It took nearly 500 years of progress to bridge this gulf between the miracle of ingenuity and the Gutenberg hand press.

The invention of printing brought with it new problems in controlling the expression of religious and other opinions. In 1515 the Church Council of the Lateran, held in Rome, decreed that no book should be printed unless it was previously approved, usually by the bishop of the diocese. In 1559 there was drawn up an 'Index' or list of prohibited books which should not be read by good Catholics without special permission; this 'Index' has been revised and added to from time to time. During the tyranny of the Stuart kings in England, a general censorship of the press was established in 1637, and later confirmed by Parliament. But this Licensing Act expired in 1693, and since that date England has had freedom of printing without any preliminary censorship. In France a rigid censorship of the press lasted until the French Revolution and was revived by the restored Bourbons after 1815. Elsewhere on the Continent of Europe censorship lasted even longer. The first amendment to the United States Constitution, adopted in Congress the same year that the government began, provided that Congress should have no power to pass any law "abridging the freedom of speech or of the press." (*See also* Electrotyping; Linotype; Monotype; Newspapers; Stereotyping.)

PRISONS AND PUNISHMENTS. As soon as firm governments had become established in the world, men began to realize that crime was not simply an injury to a private individual, but an injury to the state itself. The state imposed certain duties upon its citizens and in return it was bound to protect their lives and their property. The murderer or thief who killed or robbed a citizen became a public enemy, and it was therefore the state's duty to punish the criminal.

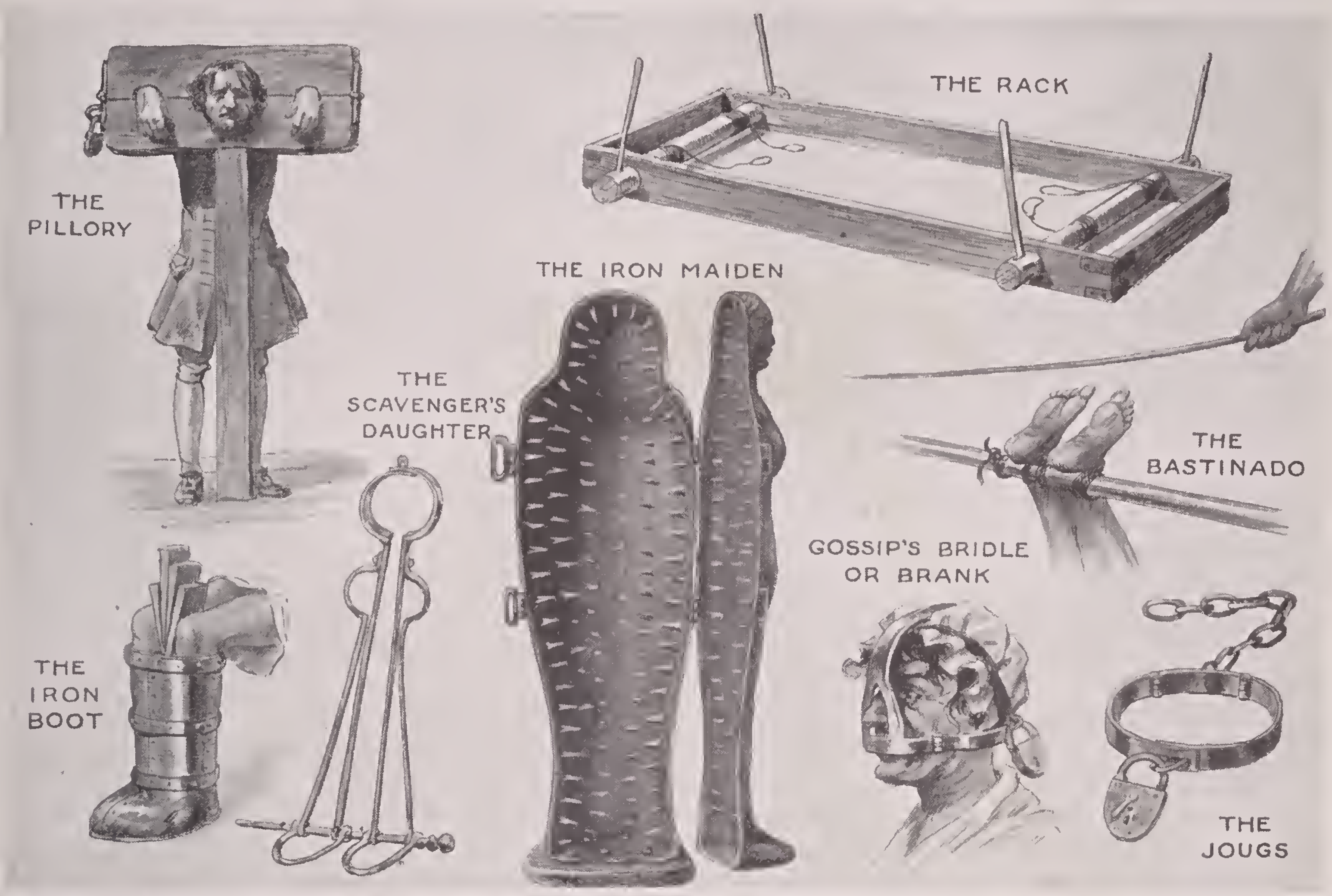
For ages punishments were inflicted chiefly in the spirit of the Mosaic law of retaliation, "an eye for an eye and a tooth for a tooth." Offenders must be made to "pay" for their crime by their own sufferings. While this feeling has not entirely died out in the popular mind, the laws of all civilized states have abandoned the idea of vengeance. Punishments are imposed now for three reasons: (1) to protect society from criminals by putting them out of the way, either by death or imprisonment; (2) to discourage others from committing crimes by showing them the fate that awaits the criminal; (3) to reform the criminal.

Until comparatively modern times, torture was used not only as a punishment but to extract confessions from the accused and to get evidence in legal trials. The practice of torture was supported by Aristotle, the great Greek philosopher, and elaborately regulated in Roman law, which became the basis for all the gruesome medieval legislation of Italy, Spain, France, and Germany. In England torture was not authorized by common law, but in the days of the Tudors and Stuarts it was practiced under royal prerogative. Condemned men were executed in the most painful ways imaginable. Burning at the stake was the penalty for certain offenses as late as the 18th century. At various times criminals were crucified, stoned to death, buried alive, torn apart by wild horses, thrown to wild beasts, or

TEACHING OFFENDERS THE VALUE OF HONEST LABOR

Would you guess that you are here looking at a prison scene? Treated in this way, and taught a trade by which he can support himself, the prisoner is not brutalized and degraded, and made a permanent enemy of society—his hand against every man, and every man's hand against him. He leaves the prison with new ideas of life and new accomplishments. These men are convicts at work in the sewing room of the great Sing Sing State Prison near Ossining, N. Y.

GRUESOME RELICS OF OTHER DAYS



Most of these horrible instruments of punishment, it is pleasant to know, are things of the past, and now to be seen only in the museums. Men were stretched on the Rack, and their imprisoned limbs crushed by wedges driven between their knees in the Iron Boot. The "Scavenger's Daughter" took its name from its inventor, a man named Skevington, the name being corrupted to "scavenger." Its purpose was to compress the body. You can see what it meant to be crushed within the Iron Maiden. The "Gossip's Bridle" was a metal frame which enclosed the head with a gag for the tongue, for the correction of scolding women. "Jougs" were iron collars by which victims were fastened to a wall, tree, or post.

made to suffer other horrible deaths. Frequently prisoners were tortured for days before their execution.

The usual methods of execution among Europeans and Americans today are electrocution or killing by an electric shock, practiced in some parts of the United States; hanging, the principal method in the United States and England; beheading, especially by the guillotine, which is used in France; and shooting, the favorite method in Latin-American countries.

There has been a tremendous decrease in the last century in the number of crimes for which death is inflicted. For students of criminology have reached the conclusion that it is not so much the severity of punishment which puts a stop to crime as the certainty of punishment. If all criminals felt sure that they would be caught and sent to prison, it would frighten them more than to see a few criminals hanged, while others equally guilty escaped altogether. In 1765 in England there were, according to Blackstone, no less than 160 offenses for which a man might be put to death, extending from the gravest crimes to petty thefts. Today, in nearly all civilized countries, capital punishment (as the death penalty is called) is used for only two crimes—treason and murder in the first degree.

For minor offenses there were formerly certain forms of punishment such as flogging, branding with a hot iron, mutilation, etc., which are scarcely less repugnant to modern feeling than the medieval torture chamber. Scolding housewives were punished by the ducking-stool, an instrument something like a long well-sweep by which the victim was repeatedly ducked in a pond. For such offenses as seditious libel, especially in books published without license, giving short weight, and brawling, favorite instruments of punishment in England or the American colonies were the pillory and the stocks, which pinned the victim's wrists or ankles while he was exposed to derision in a public place. The pillory survived as a legal punishment in Delaware until 1905, and the whipping post is still employed there. But today these forms of punishment have virtually everywhere in civilization given way to the modern penalties of imprisonment or money fines.

When the practice of inflicting prison sentences first took root, during the 16th and 17th centuries, the condition of the prisoners was deplorable in the extreme. Prisons were dark fever-breeding filthy dens, in which men, women, and children were crowded together without ventilation, and with virtually no food except what friends supplied or the jailers furnished for pay. Scarcely less wretched was the lot of those who were deported to distant colonies and forced to labor on plantations.

The credit for rousing the public conscience to the barbarism of such conditions belongs chiefly to the Englishman John Howard (1726–1790), whose horrifying pictures of prison life forced a change in the treatment of offenders. Scarcely less influential was the work of Elizabeth Fry (1780–1845), a Quaker preacher, who spent much of her life ministering to unfortunates in prison. A similar work was done in the United States by a group of Philadelphia Quakers, who began agitating for prison reform immediately at the close of the Revolutionary War, and in 1787 founded the parent prison reform society. Their efforts bore fruit before those of the English reformers, so that the United States became the first country to set an example to the world of really humane treatment of criminals. The American prison system developed here in the early part of the 19th century is now in almost universal use. This system embodied two main principles: the separation of prisoners by individual cells, and their employment at some form of labor. The use of the city or county jails for prisoners who have not been tried or convicted and for those who have received sentences of less than a year help to relieve the crowded conditions and to separate persons who are still considered innocent in the eyes of the law from the evil influence of hardened criminals. Most prisons, however, still leave much to be desired, and the problems of prisons and prison management are far from being solved.

Shortening Prison Terms by Good Behavior

Under the modern system it is often possible for a convict to shorten his term in prison by good behavior, and frequently, upon recommendation by the proper authorities, a prisoner is released "on parole." This means that he is given his freedom, provided he agrees to remain in the same state, to avoid bad habits, and to report from time to time to parole officials. Similar to the parole system is the plan of "deferred sentences," by which sentences are imposed but not enforced so long as the offender's behavior is satisfactory to the court.

In special cases, where it appears that a prisoner has been the victim of some injustice in his conviction, he may receive a pardon from the governor of the state. Most states have pardon boards whose duty it is to inquire into the appeals for pardons and make recommendations to the governor.

Young offenders are sentenced to reform schools. Here they are taught trades, and an effort is made to surround them with good influences, so they may return to lives of honesty.

PROHIBITION. On Jan. 16, 1920, every saloon in the United States was legally abolished and the manufacture, importation, and sale of intoxicating liquors for beverage purposes were prohibited. This was the result of a battle waged for over two centuries.

The first laws in America against the use of intoxicating liquors were made in Massachusetts in 1639, and at about the same time in Connecticut. Governor Oglethorpe in 1733 had the importation of rum into Georgia prohibited, as well as the importation of slaves. In 1756 a duty was put on liquors brought into Pennsylvania, and in 1774 the first Continental Congress proposed to the different states the passage of laws to stop the distilling of liquors. The ration of "grog" in the United States army was changed to coffee in 1832. At about the same time laws were passed in some states requiring a license for the sale of liquor. After the Supreme Court had, in 1847, decided in favor of the power to pass prohibitory laws, Maine was the first state to use the power. Delaware, Rhode Island, Vermont, New Hampshire, Massachusetts, Michigan, Iowa, Indiana, and Kansas all passed laws prohibiting the sale of liquors, but in most of these states the law was soon repealed and license laws passed instead. The Prohibition Party arose in 1869 from an effort to get state and national laws passed that would prohibit the manufacture, sale, and use of intoxicating drinks.

Reforms in Other Countries

In recent years the liquor problem has been seriously considered in all parts of the world. The saloon is more and more regarded as a nuisance, an injury, and a danger to society and the state. Consequently, public opinion against the unrestricted sale of liquor has made itself felt throughout Europe, as well as in America, Canada, Australia, and New Zealand. In 1904 English local magistrates were given power to refuse to renew licenses for saloons that they considered needless, compensation being paid the saloonkeeper who thus lost his license. In 1908 it was enacted that after 1922 the saloons in Great Britain could be closed without paying the owners for loss of license, and that the magistrates could close as many saloons as they saw fit. Since April 5, 1909, the people in any locality there have the power to prohibit the granting of any *new* licenses.

In the United States the Anti-Saloon League has taken the lead in the campaign since 1903, its platform having but one plank, the suppression of the saloon. It thus had the support of both total abstinence believers, and also those who, while not total abstainers, are alive to the evils and dangers of the saloon. The effort of the Anti-Saloon League has been directed in part to securing the enactment of "local option" laws, by which the voters in the villages, towns, townships, cities, or counties of a state may decide by a majority vote whether or not intoxicating liquors shall be sold in the political division in which the vote is taken. When enough prohibition districts had been established under local option in any one state, then the next step was taken—the adoption of a state constitutional amendment to prohibit liquor sales in that state. Before the World War nearly every state had some form of local option law, and over half the states were under prohibition.

On December 17, 1917, Congress passed what is known as the Webb resolution submitting to the states an amendment to the Federal Constitution providing for national prohibition. It provided as follows:

> *Sec. 1.* After one year from the ratification of this article the manufacture, sale, or transportation of intoxicating liquors within, the importation thereof into, or the exportation thereof from, the United States and all territory subject to the jurisdiction thereof for beverage purposes is hereby prohibited.
>
> *Sec. 2.* The Congress and the several states shall have concurrent power to enforce this article by appropriate legislation.

Mississippi was the first state to ratify, on January 9, 1918. Others followed until, by January 16, 1919, the required 36 states had ratified, making the law effective a year from that date.

Meantime President Wilson had signed a food production bill on Nov. 21, 1918, which contained a "rider" making the United States "bone dry," as a war measure, after June 30, 1919. Until the army was demobilized and so proclaimed by the president, no beer, wine, or other intoxicating malt or vinous liquor was to be sold for beverage purposes except for export.

PROMETHEUS (*prō-mē′thūs*). The Greeks were one of the first peoples to picture a hero who, at the cost of suffering to himself, helped to make humanity's condition better. Prometheus, their legend told, was one of the Titans, a mighty race of demigods. When men had fallen into a brutish state and the wrath of Zeus was aroused against them, Prometheus came forward as their champion. He uplifted them, taught them the useful arts, and even stole fire from heaven in a fennel stalk for their use. For this Zeus punished him by chaining him to a lonely rock on Mount Caucasus. Here he remained for ages, while a vulture devoured his liver, which grew again by night, thus prolonging his torture. He possessed a secret which threatened the rule of Zeus and for which Zeus offered him his freedom, but Prometheus refused. He chose rather to endure his torment until the appointed time, when he was released by Heracles (Hercules).

The story of Prometheus has inspired many poets, both ancient and modern. One of the greatest Greek tragedies, the 'Prometheus Bound' of Aeschylus, describes powerfully and dramatically the strength of the hero and the awful torture which he endured.

PRONOUN. Pronouns—words used in place of nouns—save us a great deal of wearisome repetition in writing and speaking. Instead of naming over and over again the persons or things we are talking about, we use such short words as *you, he, she, it, them,* etc.

The most important kind of pronoun is the *personal* pronoun. A personal pronoun indicates grammatical person by its form alone; as, *I, we, you, your, them, it.* In grammar the term *person* means the property of showing whether a word refers to (1) the speaker, (2) the person or thing spoken to, or (3) the person or thing spoken of. The word is thus said to be the first, second, or third person; as first person, *I;* second person, *you;* third person, *he.* Other kinds of pronouns are also said to be in the first, second, or third person, according to their meaning in a sentence. For example, the pronoun *who* is in a different person in each of the sentences that follow: "I *who* speak unto you am he" (first person); "You *who* listen must decide" (second person); "The boy *who* works will succeed" (third person). The personal pronoun, however, is the only kind that shows grammatical person by its form, when standing alone. Besides person, pronouns also have the other properties which belong to nouns; *gender, number,* and *case* (*see* Nouns).

Other important kinds of pronouns are the *interrogative,* the *demonstrative,* and the *relative* or *conjunctive.* An *interrogative* pronoun is a pronoun used to ask a question; as, "What is that?" A *demonstrative* pronoun is one that points out some particular person or thing; as *this, that.* A *relative* or conjunctive pronoun is a pronoun used to join a clause to a substantive; as, "It's a long lane *that* knows no turning." *Who, which,* and *that* are the most common relative pronouns. (It should be noted, however, that each of these words has other uses.)

The "How" of "Who," "Which," and "That"

The relative pronoun *who* should always be used to refer to persons; the relative pronoun *which* should always be used to refer to things or ideas; the relative pronoun *that* may refer to either persons, things, or ideas. A relative pronoun has two uses in the sentence; as a connective it joins its clause to its antecedent, that is the word to which it refers; as a pronoun it is used in this clause like a noun. In the sentence above, the relative pronoun *that* joins the clause "that knows no turning" to the pronoun *it,* and is used as the subject of the clause. If in doubt as to the use of a relative pronoun in its clause, substitute the antecedent, making the clause a separate sentence; as, "The boy *who,* we thought, was good for nothing became a daring aviator"; or "The boy *whom* we thought to be good for nothing became a daring aviator." In the first sentence *who* is subject of the clause, and *we thought* is thrown in parenthetically; in the second sentence *whom* is subject of the infinitive phrase *to be good for nothing,* and with it is used as the direct object of the verb *thought.* This is proved by substituting the antecedent *boy:* "The boy, we thought, was good for nothing"; "We thought the boy to be good for nothing."

Different Forms of Pronouns

Five personal pronouns, and the relative or interrogative pronoun *who,* each have separate forms for the nominative and the objective cases, as follows: *I, me; he, him; she, her; we, us; they, them; who, whom.* Also the old-fashioned forms *thou, thee; ye, you* are still occasionally used. They also have *possessive* forms, which are sometimes called possessive adjectives; as, "*My* book, *your* dog, *his* duty, *their* pleasure," etc. Some of the personal pronouns have separate possessive forms which are used when the pronoun is to stand alone; as *mine, yours, hers.*

The declensions of the personal pronouns are as follows:

First Person

	Singular	Plural
Nom.	I	we
Poss.	my, mine	our, ours
Obj.	me	us

Second Person

	Singular	Plural
Nom.	you (thou)	you (ye)
Poss.	your, yours (thy, thine)	your, yours
Obj.	you (thee)	you

Third Person

	Singular			Plural
	Masc.	Fem.	Neut.	All Genders
Nom.	he	she	it	they
Poss.	his	her, hers	its	their, theirs
Obj.	him	her	it	them

The relative pronoun *who* has the same forms for both singular and plural: nominative, *who;* possessive, *whose;* objective, *whom.* The only other pronouns commonly inflected are *this* and *that,* which have as plural forms *these* and *those.*

Some difficulties in the use of pronouns arise from the failure to choose the right case-form, and from the failure to make a pronoun agree with its antecedent in number. The case of a pronoun is not determined by the case of its antecedent, but by its own use in the sentence (as we have seen in the examples given in the fourth paragraph of this article). It should be clearly understood that the case to be used when a sentence element is compound (*see* Sentence) is the same that would be used if the pronoun stood alone. Many people who would never say "*Me* did it" or "He brought it to *I*" will say "John and *me* did it" or "He brought it to John and *I*," instead of "John and *I* did it" and "He brought it to John and *me*."

The number and gender of a pronoun are determined by the nature of its antecedent. If the antecedent is of common gender, the masculine pronoun is used; as "*Each* of the children held out *his* hand." *Each, every, either, neither,* though they suggest always more than one, are singular when used alone or with singular nouns, since they always mean *one at a time.* Therefore singular pronouns should be used referring to them. In the sentence above, for example, "Each of the children held up *their* hands" would be incorrect.

Pronouns that Play Many Parts

Since pronouns represent persons, things, and ideas, without naming them, one pronoun may take the place of many different nouns. Hence in using them great care is necessary to make the reference of each pronoun immediately and perfectly clear. The pronouns *this, he, it,* and *which* are especially apt to be used indefinitely.

The correct use of pronouns is one of the surest marks of the careful writer and speaker. Probably the majority of people make errors in the use of these common words every day of their lives. Some of the mistakes to be guarded against are illustrated in these sentences:

"John was *hungry,* but *it* did not distress him so much as *it* did Frank." *It* is here used without a grammatical antecedent. The correct form would be: "John was hungry, but he was not so much distressed as Frank was."

"I can spell better than *him.*" *Him* is incorrectly used for *he.* The nominative form is required, as the subject of the verb *does,* to be supplied.

"*Those* kind of books don't interest me." The pronoun should be in the singular, *this,* because it modifies the singular noun *kind.*

"Give me *them* skates." *Them* is a personal pronoun and cannot be used as a demonstrative pronoun to modify a noun.

"She is a girl *who* I know you will like." *Who* should be *whom,* since the pronoun is used as the object of the verb *will like.*

"She is a girl *whom* I know will make good." *Whom* should be *who,* as the subject of the verb *will make.*

"The tree lost *it's* leaves." *It's* for *its.* Notice that the possessive forms *hers, its,* and *theirs* do not have the apostrophe before the *s.*

PROPHETS. We commonly think of a prophet as one who foretells future events, but as used in the Bible the word has a deeper meaning. In the Bible a "prophet" is one who speaks for God. Hebrew prophecy is sometimes said to begin with Moses, who in after-times was regarded as the first and greatest of the prophets. Others regard Samuel as the first of the prophets.

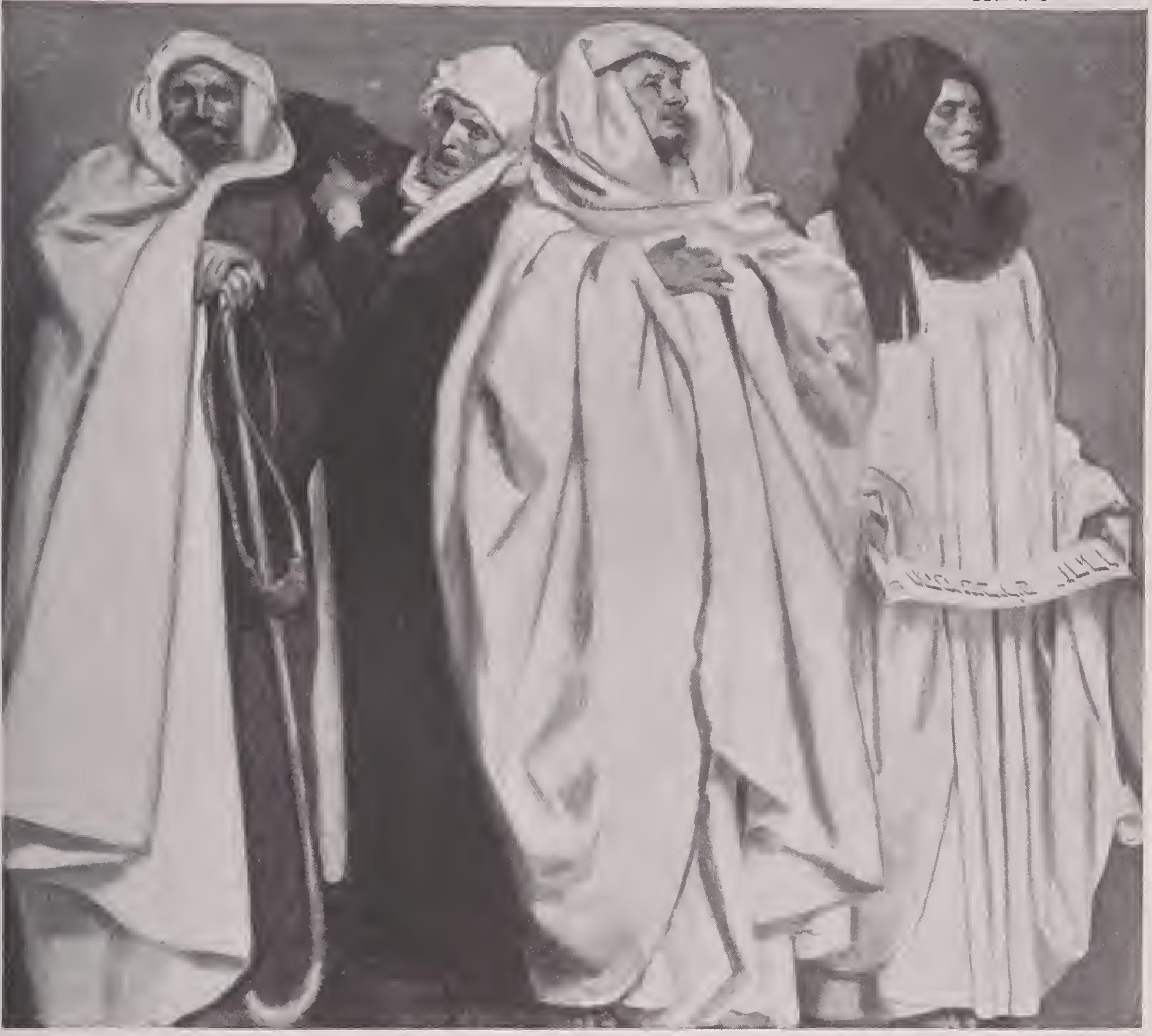
In a special sense the title belongs to those great Hebrew reformers and leaders who, in times when the people of Israel had fallen into evil ways, when they had given themselves up to idolatry or to the pursuit of material things, sternly and fearlessly rebuked them; or, in times of great national disaster, strengthened their faith by assuring them of God's mercy. Such a prophet was Elijah, who battled for Jehovah against the priests of Baal, and is represented as being carried up to Heaven in a chariot of fire, his mantle falling upon Elisha, his successor.

Later we find a succession of inspired leaders, who were writers as well as teachers and men of action, and whose words have come down to us in those parts of the Bible known as the Prophets. The first of these "literary prophets," as they are sometimes called, was Amos, a simple herdsman from Tekoa, who dared to denounce the men of wealth and power, living in luxury built upon the poverty of the people. Then came Hosea, pleading fervently with the people to remain faithful to Jehovah; and Isaiah, with his sublime vision of the day when the God of Israel should be worshiped by all the world.

Another great prophet was Jeremiah, who arose in the dark days before the Babylonian conquest. He was hated because he announced the impending doom of Judah, and was held to be a traitor because he set loyalty to God above loyalty to king and country. Jeremiah was followed by Ezekiel, who was among the captives carried to Babylon. Like other prophets, he was stern in condemning the wickedness of his nation, but he likewise brought consolation by picturing the new life that Jehovah would breathe into the dry bones of Israel.

The prophet Daniel is the hero of the biblical book which bears his name. Carried captive from Jerusalem to Babylon, he won the favor of King Nebuchadnezzar through his wisdom and ability to interpret dreams, and became one of the highest rulers in the

A GROUP FROM THE FAMOUS 'FRIEZE OF THE PROPHETS'



These figures from the 'Frieze of the Prophets' by John S. Sargent in the Boston Public Library represent, in the order named, Amos, Nahum, Ezekiel, and Daniel. This frieze is one of the most ambitious and original of the works of this great American artist and it is universally agreed that it deserves high rank among the works of moderns who have dealt with sacred subjects.

Babylonian kingdom. When "Darius the Mede" captured Babylon, Daniel continued in high position until jealous princes contrived to have him thrown into a den of lions, where he was miraculously preserved from the savage beasts.

The "Law" and the "Prophets" are two great divisions of the Old Testament as arranged by the Jews. The Law comprises the five books of Moses; and the Prophets consists of the "major prophets"—Isaiah, Jeremiah, and Ezekiel—and the 12 "minor prophets" (so called because of their brevity)—Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, and Malachi. The remaining books are classed as "Hagiographa" or "Holy Writings"; the Book of Daniel is placed in the Jewish Bible in this last group. (*See* Bible; Jews.)

PROTECTIVE COLORATION. It seems plain that the most useful coloring for an animal whose life is spent in trying to avoid dangerous enemies would be the one in which it could least easily be seen; and countless races of animals have gradually obtained such a coat—sometimes in amazing perfection. The most unmistakable examples are to be found among the most helpless—those who have little or no other means of defense; and this seems to show that it is by this "safety first" feature that their races have managed to continue to live in a world of merciless warfare. Almost all the small swimming creatures in the sea, and the fry of many fishes, are transparent, so that they are quite invisible in water; a ribbon-shaped baby eel, for instance, is as clear as glass. Nearly all fishes, a group of animals whose only means of defense, as a rule, is in flight, are bluish on the back—a tint not readily seen under water. Inshore species, such as the anemones and worms between tidemarks, are the color of mud when their tentacles are withdrawn; and the ground-running insects, and bigger things in open spaces, such as the western horned toads, are the color of soil or sand, and easily overlooked. The same is true of the hosts of insects that live and feed amid the foliage of trees and bushes or in the grass, matching it by their green or green-mottled coats. Try to find a noisy katydid in an apple tree, and you will appreciate the difficulty of the search.

The Hunters and the Hunted

But, you may say, birds, wasps, and other hunters catch these hiders every day. So they do, but not so easily nor numerously as they would if their captives showed themselves scarlet on the ground or golden amid green foliage; and furthermore, their "disguise," so to speak, is serviceable only so long as they keep still. You have heard of the Oriental leaf-butterfly, the upper surface of whose wings is gaily painted, but when it alights, instantly folding its wings together above its back so that their streaked brown undersurface alone appears, it becomes so like a leaf that the sharpest-eyed natives pass it by unnoticed. Many a one has been surprised to have what seemed a scale of bark on a tree trunk spring into color and flutter away as a moth. So long as such a creature is motionless its similarity to what it rests upon keeps it fairly safe, but the moment it moves it is seen. In some young animals, for instance whippoorwill chicks, the instinct of trusting to immobility is so strong that you may pick them up from the woodland floor—if you can find them!

This brings out an important point, namely, that in most cases the "protected" animal is in no great danger when it is wide awake and active. It needs most the safety its color gives when it must rest or sleep or care for its young. Here is where protective coloration is chiefly of value to birds, and it explains why it is that in so many kinds of birds the female wears a very plain dress while her mate is gaudily feathered. The scarlet tanager, the black-birds, the grosbeaks, and the indigo-bird are familiar American examples. The gay fathers of the families can take care of themselves pretty well, for they are free to fight or flee when danger threatens; but the mothers must sit steadily on their nests, where they would quickly be seen and pounced on by some prowling cat or other bird-killer were they wearing bright colors. If this is true of those mentioned, which nest under the cover of leaves, how much more is it true of those, like the killdeer, whose nest lies on open ground. Not only does the mottled back of the sitting mother in such cases so blend with the earth and weeds about her that she usually escapes notice, but even her brown eggs are all but invisible when exposed by her absence. Such enemies as find the nest are probably guided by smell.

The grass-frequenting sparrows are streaked dark brown and buff or gray, like the dry grass in the fields; the bitterns are more broadly striped, like the cat-tails and sedges of the marshes; the grouse and woodcock are mottled brown and buff, like the dead leaves of the forest floor, etc.

But nature has gone even further than this. Artists have long known how to make objects stand out on the canvas by shading the under side to imitate a shadow thrown by a solid figure. The artist-naturalist, Abbott Thayer, has pointed out how the exact opposite of this principle is applied to birds and animals, causing them to become inconspicuous by destroying the appearance of shade on their underparts. This is brought about by their being colored lighter below, in exact proportion to the amount of shade received; so that they are practically pure white on the middle of the belly, with a gradual change to the dark upper parts. Furthermore, wherever else a shadow is thrown, as by the bill on the chin, that spot is colored much whiter. When the solid appearance of a bird is thus destroyed, if its color and pattern are those of its background, it becomes absolutely invisible at a short distance. This principle is called "counter-shading."

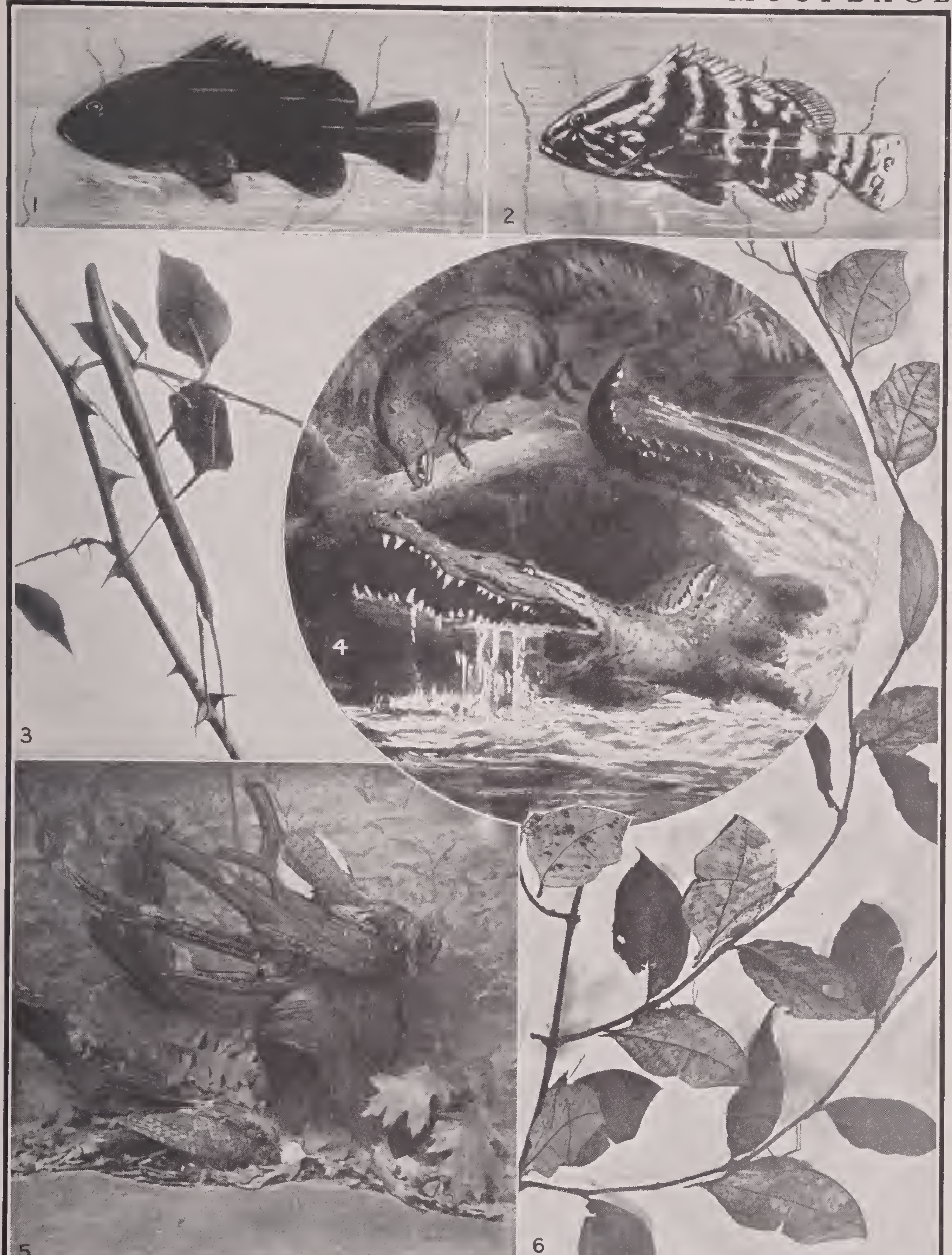
Another very different principle of protective coloration is that called "ruptive marks," in which conspicuous black and white marks are placed close together. Examples of this principle are found in the black bands across the white breast of the killdeer, and the white ring around its neck; and also that around the neck of the kingfisher and the mallard duck. Such marks seem to cut off the head of the bird, or to break up the bird into several pieces, thus destroying its continuity of form. In this way the eye of the enemy is attracted to some one part rather than to the bird as a whole, and it appears like something else. Both of these principles were used extensively during the World War of 1914–18, under the name of "camouflage," to conceal large guns, battleships, motor trucks, etc.

Banner Marks in Animaldom

A third method of protective coloration is called "flash colors" or "banner marks"; it is exemplified by such conspicuous marks as the white rump of the flicker, or the white outer tail feathers of the meadowlark and other birds, which can be concealed or displayed at will. The white rump of the flicker, for instance, is very conspicuous in flight and would naturally be the target of any pursuing hawk. When the flicker claps up against a tree, however, closing its wings, this spot disappears, and the hawk is confused sufficiently to permit the flicker to slip around to the other side of the tree.

There is a way also in which likeness in color to its customary surroundings helps the hunter as well as the hunted. The method of capturing prey by ambush is common among beasts of prey, from the muddy crab in the eel-grass, or the weed-grown snapping-turtle, and the alligator looking like a

SIX EXAMPLES OF NATURE'S CAMOUFLAGE



The Nassau Grouper, like some other tropical fishes, turns dark when alarmed (1) and makes for a shadowy hiding place. Normally he is brilliantly colored (2). Can you find the Stick Insect (3), two Whippoorwills hiding (5), and seven Indian Leaf Butterflies (6)? In the center you see the tragic fate of a Peccary who mistook an Alligator's tail for a log.

floating log, to the tiger, his stripes matching the streaks of sunlight and shadow among the tall grass; all are lurking until some unsuspecting victim comes near enough to be leaped upon. With no other dress could the ambush succeed.

PROTEINS (*prō'tē-ĭnz*). In order to grow and to repair the wear and tear that is constantly going on in the tissues, every living thing must have a constant supply of protein. Protein differs from all other kinds of food substances in that it alone contains the nitrogen that is necessary to life. It is the most important of all foods, and that is why it was given its Greek name, which means "of first importance."

However richly a man may be supplied with sugar, fats, starch, and salts, he cannot live without protein. And while sugar and fats are better fuel for the body, proteins supply fuel also, and maintain life without fats or carbohydrates.

The greater part of the solid matter of all animal cells and tissues, and also various parts of the structures of plants, particularly the seeds, are made up of various kinds of proteins. Most plants—those that have green coloring matter, or chlorophyll—can make protein for themselves, but all animals and human beings and those plants which, like the mushroom, contain no chlorophyll, must obtain it ready-made. There are nearly 40 different kinds of vegetable and animal protein, most of which are suitable food for us.

Some of the well-known members of the protein family are the gluten of wheat, albumen of eggs and meat, casein of milk, and legumin of peas and beans. The dried white of an egg is almost pure protein; so is the gummy mass left after wheat is chewed for a long time. Plant foods rich in protein are wheat, corn, oats, peas, beans, peanuts, lentils, and nuts. The animal sources of protein are meat, milk, eggs, and cheese.

The continued over-eating of protein, however, may lead to very serious ills, for while we can store up as fat an excess of sugar and fats that have been taken into the body, we cannot store up protein. It must be used up at once, or broken up and expelled from the body. Now the breaking up of proteins in the body is difficult, as they are so very complicated in their chemical composition, and many of the products of the breaking-up process are poisons. So to keep in perfect health it is necessary that our diet be well balanced, containing only the protein supply which we need, with a proper proportion of fats, carbohydrates, and mineral salts. (*See also* Food.)

PROTEUS (*prō'tē-ŭs*). The ancient Shepherd of the Deep lay at noon in his hollow cave by the Ocean's shore, and all about him slumbered the well-guarded sea-calves, or seals, as we should call them, which the god Poseidon had intrusted to his care. But four of his flock had secretly been slain, and in their skins lay hidden King Menelaus and three of his trusted followers. These survivors of the great Trojan War had come to wrest from Proteus the secret of the contrary winds which kept them from their far distant homes.

When Proteus, having counted his flock, lay down to rest, Menelaus and his men threw off the skins and seized him. Then Proteus' hair became transformed into a mane and his body into that of a raging lion. But his captors did not relax their grasp, for they knew his cunning wiles. Then he sought to writhe out of their hands as a snake. Next he became a leopard, and then a fierce wild boar. Even when he took the shape of running water and of a tall and flowering tree, they held him fast.

At last, wearied of the struggle, Proteus resumed his proper form and revealed to Menelaus how by sacrifice he might appease the wrath of the gods and be granted favorable winds to waft him homeward. When questioned further he told how Agamemnon, the brother of Menelaus, had met a treacherous death; and how fared the other leaders of the Greek hosts. Thus having prophesied, the ancient one was released and plunged into the depths of the sea.

Such is the story which Homer tells of Proteus. He was one of the many lesser divinities that followed in the train of the sea-god Poseidon (Neptune), and perhaps typifies the ever-changing aspect of the sea. His name has given us the adjective "protean," meaning "variable."

PRO'TOPLASM. The fairy godmother of every living thing—of plants and animals and ourselves—is a drop of magical jelly that we call protoplasm. It gets its name from two Greek words which mean "first material," because it is the "stuff" out of which every living thing is made.

This protoplasm is really the only thing in the universe which is alive. Plants and animals are alive, because they are made up of this wonderful life-substance, but minerals are not alive, because they have no protoplasm.

What is it to be alive? A bit of cloth or blotting paper can soak up water, but it cannot use it or make anything out of it. A silkworm eats mulberry leaves, grows larger on this food, makes a silk cradle to sleep in, and hatches out into a butterfly that lays more silkworm eggs. To be *alive* is to eat and *grow*, and turn the food into something else, and—don't forget this—make more living things like itself. That is why we know that the little drop of jelly is alive. It is the smallest, simplest *live* thing in the world. (*See* Biology; Cell.)

Chemically, protoplasm consists chiefly of carbon, hydrogen, nitrogen, sulphur, and oxygen. The scientist Huxley calls it "the physical basis of life." In active living cells protoplasm is usually a colorless bubbly thick fluid, which is seen under the microscope to be in ceaseless motion. In cells at rest, such as seed-cells, the protoplasm becomes much harder, sometimes as hard as bone. The thinner more watery protoplasm which surrounds the nucleus of the cell is usually called *cytoplasm*.

PROTOZO'A. If you dip a glass of water from a stagnant pond and look through it toward the light you will see a multitude of tiny creatures so small that they are hardly visible. If you take a single drop of this water and examine it under a powerful microscope you will find that it contains a number of still smaller creatures. These are so small that a single drop of water is a whole world to them. They are the lowest forms of animal life and are called "protozoa," from the Greek words meaning "first life." Each one is a complete little animal, though it is composed of only a single cell.

One of the commonest of these single-celled animals is the amoeba (*see* Amoeba). Like a poor family that can afford no more than a single room to live in, the protozoa must do all their growing and living within the one tiny cell that forms their body. We get an idea of how small they are from the fact that a pint of water may contain millions of them.

Tiny as the protozoa are, some of them actually build a little house or shell for themselves out of lime or some similar substance which they make in their own bodies. These are the *foraminifera*. If you examine them under the microscope you will find that their shells are often just as intricate and beautifully made as the large shells you pick up by the seashore. Through centuries the little shells of the foraminifera have fallen to the bottom of the seas, and in this way our great chalk cliffs and beds have been formed. The *infusoria* are still another branch of the protozoa. They are interesting because they have little hairs to swim with, and some of them actually have mouths.

There are other protozoa, also, which live as parasites on higher animals, including man, and often cause dangerous diseases. For instance, malaria, yellow fever, sleeping sickness, as well as some other diseases, are believed to be caused by forms of protozoa which find their way into the blood and other parts of our bodies. (*See* Bacteria; Cell; Germ Theory of Disease.)

PROVIDENCE, R. I. Between 1787 and 1841 Providence—like Boston, Salem, and Newport—was a busy port for the China and India trade. There were plenty of things that New England wanted from China—tea, coffee, muslins, silks; but there was little that China would accept in return except good solid coin, and gold and silver were scarce in old New England. Therefore the cargoes outward bound at first consisted chiefly of things brought in by other voyages from Sweden, St. Petersburg, France, Spain, Madeira, and the West Indies. Then it was found that China wanted also the wonderful furs obtained in America by trade with the Indians, and the difficulty was partly solved. Six months might be spent in getting the cargo aboard the great square-rigged ships. But this was as nothing to the length of the voyage to China and return—under sail across the Atlantic, around the Cape of Good Hope, through the Indian Ocean and past Singapore to Canton.

The commercial interests of Providence had their beginnings in the 17th century, and in 1711 shipbuilding began. But in those days before the Revolution the ships of Providence were busied chiefly in a great triangular trade in which, it has been said, one-fourth of the signers of the Declaration of Independence were bred, but which we now consider a shameful business for a free country. A ship taking lumber to the West Indies would bring back sugar and molasses to be distilled into rum. The rum would be shipped to the west coast of Africa and there traded for slaves, which in turn were sold in the West Indies or the Southern states to buy more sugar and molasses. Rhode Island merchants were thus the greatest slave-traders in America. Samuel Hopkins said in 1770 that there were 150 ships engaged in the slave trade, 30 distilleries making rum, and that his fellow colonists had "enslaved more Africans than any other colony in New England."

A Fine Harbor for Small Ships

For the old-time sailing ships Providence, although situated 35 miles from the open sea, at the head of Narragansett Bay, was a perfect harbor; but for the great steel steamships of today its approaches are too shallow. The last of the old-time Indiamen of Providence disappeared with the growth of steam navigation and manufactures about 1841, and since then Providence has declined as a port. But it still ranks high in bulk of tonnage and value of cargoes. Coastwise steamers bring coal from New York, Norfolk, Newport News, and Baltimore for Rhode Island's teeming factories, and one transatlantic line to the Mediterranean has found docks at the new state pier. Something of the skill which built the old clipper ships still survives in the shipyards at nearby Bristol, where numerous "greyhounds of the sea" have been built to defend the famous *America's* Cup, first won from Great Britain by the racing yacht *America* in 1851.

Present-day Providence, like the whole of Rhode Island (of which it is the capital), is chiefly interested in manufactures. It is the second largest city of New England, and ranks first in the country for the manufacture of jewelry and silverware. It is also an important city for cotton goods, woolen goods, engines, boilers, and fine tools. Like other industrial centers it has a growing foreign population, tending to settle by national groups.

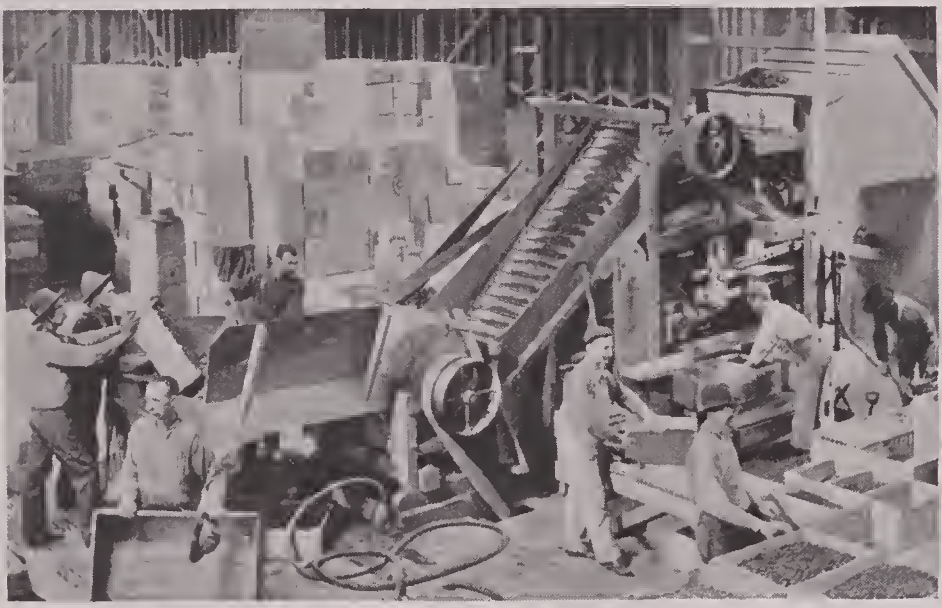
Relics of Former Days

Providence preserves a number of its old landmarks. Roger Williams Park, a beautiful 432-acre municipal reservation, is a part of the original tract ceded by the Indians to Roger Williams, who founded Providence in 1636. The meeting house of the First Baptist Church dates back to 1775 and the Friends' Meeting House to 1759. There are a number of old houses, and some of the street names are interesting as pointing to Quaker influences and to Providence's early commercial importance (Pound Street, Shilling Street, Dollar Street, etc.).

Brown University, chartered in 1764, is one of eight American colleges founded before the Revolution. The John Carter Brown Library, gift of a descendant of the original Nicholas Brown, is probably the most important collection of early Americana in the world, especially of books printed before 1800; and many of its small battered volumes cost nearly their weight in gold. Population, about 240,000.

PRUNES. The history of the prune industry in the United States is one of the most remarkable records of growth in American agriculture. The first exhibition of cured prunes was made at the California State Fair in 1862 and the first commercial orchard was planted in 1870; yet now the three Pacific states, California, Oregon, and Washington, produce a larger amount than all foreign countries put together. Not only is the home market supplied, but large quantities of the best grades of fruit are exported to Europe, where they rank with the best French brands.

PRUNES STARTING TO THE GROCERY



By means of machinery, which handles them very rapidly, prunes are boxed and shipped after they have completed the sweating process and been properly graded according to quality and size.

Prunes are plums of certain varieties that can be dried whole—that is, with the seeds left in. They are among the most nutritious of foods. To produce a high grade of prunes, the plums must be meaty and have a high percentage of sugar. (*See* Plum.)

The plums are left on the tree until they are so ripe that they fall to the ground. Then they are gathered, graded, and cured. There are three methods of curing: sun-drying, which is practiced in California, and in some parts of Europe where there is a sufficient period of dry hot weather; curing in evaporators, which is the general method in the northern Pacific states; sun-drying or evaporating after the fruit has been partially cooked, a method practiced chiefly in eastern Europe.

Before curing, the prunes are dipped in a weak lye solution to clear off the "bloom" and weaken the fiber of the skin so the drying process will be easier. After a thorough rinsing the fruit is placed in wooden or wire-bottomed trays for curing. Sometimes the skin is punctured with needles in a pricking machine. Six to ten days' exposure in the sun, or from 12 to 48 hours in the evaporators, will thoroughly dry the prunes. When dried, the prunes are put in bins or piles to "sweat," and after two or three weeks they are ready to be graded and packed. They are graded according to the number required to make a pound; the largest grade 30 to 40 to the pound, the smallest 120 to 130. Before they are packed the prunes are "processed" by being dipped into a hot water and glycerin or fruit solution, which adds to their attractiveness. Sacks and boxes are generally used for packing, although some of the choicer grades are packed like dates.

The prune is supposed to have been introduced into France from Turkey or Persia near the close of the Crusades. The greater part of the European product is grown in France and Bosnia. The most important varieties in California are the French Petite or "Prune d'Agen," Imperial, Robe Sargent, and Sugar prunes; in Oregon, the Italian (Fellenberg) is most generally cultivated. They come into profitable bearing when five years old.

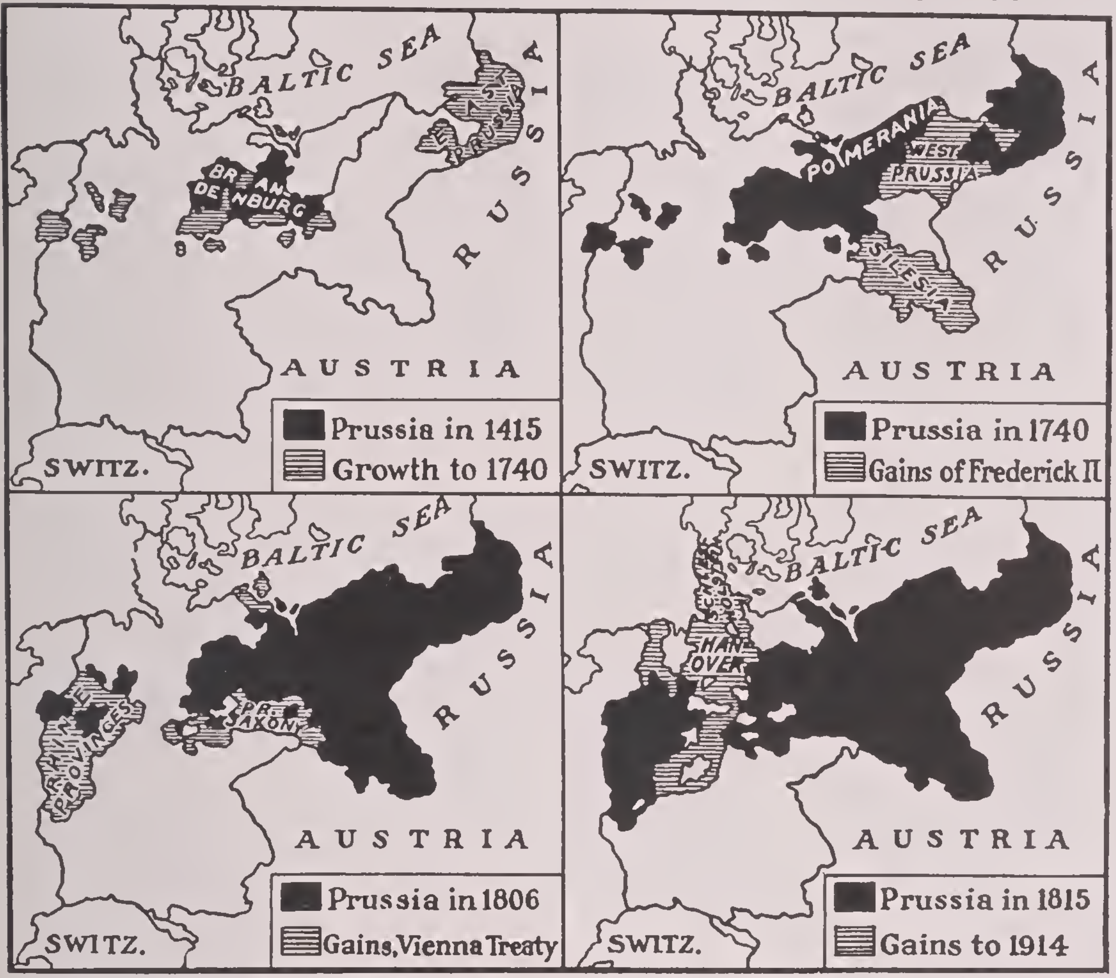
PRUSSIA, GERMANY. The ruins of the old castle of Hohenzollern, from which the former ruling family of Prussia takes its name, may still be seen as the center of a little narrow strip of Prussian territory in the far southwest of Germany, near the headwaters of the Danube River. But what a contrast there is between those days of early weakness and Prussia's military might at the beginning of the World War!

Three factors produced the power of the Prussian kingdom—the able and unscrupulous Hohenzollern dynasty; the "mark" (border territory) of Brandenburg, with Berlin as its capital; and the duchy of Prussia, lying beyond the Vistula River in lands conquered in the 13th century by the crusading order of Teutonic Knights from a heathen people akin to the Slavs (*Borussians*), and made a secular duchy at the time of the Reformation (1525) under a collateral branch of the Hohenzollerns.

The first great forward stride of the main line of the family was made in 1415, when Frederick of Hohenzollern used the wealth which he gained as "burggraf" of Nuremberg to buy from the Emperor Sigismund the rule over Brandenburg. Its possession made the Hohenzollern prince one of the "seven electors" of the Holy Roman Empire. But Brandenburg, lying in the northern plain between the Elbe and the Oder rivers, was a poor flat country, with barren sand hills heaped up by the inclement winds. Gradually its Hohenzollern margraves (German *markgrafen,* "border counts") increased their territory—northward at the expense of Pomerania and Mecklenberg and southward at the cost of the Saxon marks. In 1609 the acquisition of some small isolated territories on the middle Rhine gave them a footing in western Germany.

The third important factor was added in 1618, when the duchy of Prussia fell by inheritance to the margrave of Brandenburg. It was the task of "the Great Elector," Frederick William (1640–1688), and of his successors to round out, consolidate, and strengthen these scattered possessions into a strong military state. Long wars with the Slavs and the absence of defensible frontiers had already given a military stamp to the Brandenburg-Prussian power. The Great Elector's son, Frederick I, won the title "king in (of) Prussia" in 1701. His son, the rough father of Frederick the Great, is chiefly remembered because of his fostering care of the Prussian army, and for the regiment of giants that he recruited from all over Europe—by gift, purchase, and even kidnaping.

PRUSSIA'S GROWTH THROUGH FIVE CENTURIES



The history of Prussia may be said to begin in 1415, when the Hohenzollern family gained possession of the little electorate of Brandenburg. For two centuries there was no indication that this poor flat country was destined to be the nucleus of the greatest of the German states, but after the Hohenzollerns acquired East Prussia in 1618, their dominions steadily grew until they included two-thirds of the territory and three-fourths of the population of all Germany.

What could be done by the unscrupulous use of this Prussian military power was shown by Frederick the Great (Frederick II) in his long reign from 1740 to 1786. The territory of Prussia was almost doubled by the conquest of Silesia from the young and beautiful Maria Theresa of Austria, and by the annexation—through the first partition of Poland—of West Prussia, which separated the Duchy of Prussia from Brandenburg. Incidentally Frederick helped to confirm in Prussia that belief in aggressive war as its "national industry" which lay at the root of Germany's part in the World War of 1914.

But when Prussia measured arms with Napoleon on the field of Jena, in 1806, her armies were crushed. The reorganization carried on by Baron Stein and others enabled Prussia to take her part in the final overthrow of Napoleon in 1813–15, and as a result her territories lost to the French were restored and enlarged. A "zollverein" or customs-union helped to pave the way for political unity of the German states under Prussian headship. As a result of revolutionary movements of 1848–49 the Prussian king granted a constitution for his kingdom, in which however there were comparatively few democratic features.

Bismarck's unscrupulous diplomacy in provoking war with Demark in 1864, with Austria in 1866, and with France in 1870, brought Prussia increased territory and the coveted German headship. Schleswig-Holstein, the kingdom of Hanover, Nassau, Hesse-Cassel, and Frankfort-on-the-Main were all absorbed into Prussia; and the Prussian king was proclaimed emperor as William I (1871–1888) of the new German Empire. Thenceforth the history of Prussia is merged in that of Germany. (*See* Germany.)

It is not surprising that Prussia practically controlled the new German Empire. It included two-thirds the territory and three-fourths the population; its king was hereditary German emperor and "war lord"; the army and administration were completely dominated by Prussia; 236 out of the 397 members of the Reichstag were elected from Prussia, and by means of the 17 (later 21) votes which the Prussian government cast in the Imperial Council (Bundesrat), it could veto in that powerful body any measure distasteful to it. We might almost say that Prussia was Germany between 1871 and 1918.

The revolution and peace treaty which followed the World War left Prussia still the most powerful state of Germany. Its area, which formerly was a little larger than that of Ohio, Indiana, and Illinois—about 134,650 square miles—has been reduced by about one-sixth. It still contains the chief industrial regions of Germany, nearly a score of cities of over 100,000 population, and all the important seaports except Hamburg, Bremen, and Lübeck. A republican form of government was set up in November 1918.

The WONDERFUL SCIENCE *of the* MIND

PSYCHOLOGY. William James told the young women of Radcliffe College that the end of an education is "to know a good man when you see one." This half-jesting remark is in a real sense the true aim of the study of psychology. Where men must work together as they do in modern civilized life it is necessary that they understand one another, that they have similar ideas and harmonious modes of conduct. A parent must know how his child thinks and feels if he is to direct his conduct; a teacher must know what ideas pupils already have if she is to be able to teach them more complicated ideas. Children must similarly understand parents and teachers if they are to learn the things they should know. In like manner an employer must understand his workmen, an officer his soldiers, and the judge must understand the prisoner who is on trial. This necessity for mutual understanding has always existed wherever men have tried to work together, but in modern times the need is greater because the things men now try to do are so much more complex. Think of the amount of understanding and coöperation necessary in building a bridge over a big river!

When men collect facts about the behavior of human beings, organize these facts in a systematic way, and study out their relations, they call it "psychology" (from the Greek *psyche*, meaning "soul," and *ology*, "science"). Psychology, therefore, means "the science of the mind."

A further reason that men study psychology is that they are curious about the workings of their own minds. They are interested in their own ideas and feelings, and in the causes of their own conduct. Many persons have this interest without becoming psychologists. It is only when they gather facts in a systematic way and try to formulate the laws which govern such facts that they become scientific students of psychology.

Facts with which Psychology Deals

A few of the most important facts and laws of psychology have been known and stated for many centuries; but it is only in relatively recent years—in fact in the last half-century—that most of our information has been discovered and made available. A brief statement of the range of facts now included in psychology may be given.

First of all, there is the matter of *sensation* and *perception*, or what we learn through the senses—the eye, the ear, the sense of touch, etc. The ancient Greeks thought there were just five senses—sight, touch, taste, smell, and hearing; but the modern laboratory investigations have shown that there are many more, just how many we are not able to tell. A complete list of sensations would include heat, cold, pressure, pain, thirst, hunger, and equilibrium, in addition to those mentioned above.

Then there is the problem of *association*. Our ideas "follow each other through our thinking," and psychology attempts to discover and state the laws which govern this stream of experience. Aristotle long ago stated certain of these laws, and every psychologist since has striven to understand and explain the phenomena. But we not only associate our experiences; we recall them and recognize that they belong in some way to our past—that is, we "remember" them. The subject of *memory*, therefore, constitutes one of the large chapters in psychology.

This study of sensation, of perception, of association, and of memory leads to an inquiry as to how people meet new situations, solve problems, and reason out better ways of doing things. Thus we have chapters on imagination, thinking, judgment, and reasoning. The person who does these things successfully we call intelligent, and thus we frequently have a chapter on *intelligence*, dealing with the successful performance of these processes.

Emotions and Behavior

We all know, whether we are formal psychologists or not, that our sensations, memories, and judgments are often accompanied by feelings which, when they are pronounced, we call fear, anger, joy, etc. All systematic psychologies contain, therefore, a chapter on the *emotions*, although it is usually admitted that we know less in a scientific way about the emotions than about many other things.

But more pronounced than the intellectual processes first described, and more obvious than the emotions, is the tendency of human beings to act, to do things. Many things are apparently done without thought or emotion, and it is customary to call such behavior *instinctive*. These instinctive tendencies to action are apparently hereditary, and one does not need to learn them. Through learning, however, the instincts are modified into new forms of behavior and we thus come to a discussion of *acquired behavior*, of *habit*, and of the *will* or voluntary action, subjects which occupy many pages in psychological books.

By psychology, therefore, we mean the study of all these things about human beings—of sensations, of association, perception, memory, reasoning, emotions, and conduct, from the simplest to the most complex.

For certain purposes and by certain persons particular aspects of psychology are emphasized. When sensation, association, memory, emotion, and other mental processes are traced to changes in the body, particularly to changes in the nervous system and in the brain, we call it "physiological psychology."

Psychology has important relations to medicine. Certain diseases like hysteria arise from deranged mental conditions. Unstable emotional conditions such as fear, anger, or love produce distorted complexes of ideas that make an individual behave "queerly." The great emotional strain of the war produced in soldiers many such mental aberrations popularly known as "shell shock," because it was at first supposed that the explosion of a shell in the vicinity of the victim was the cause of the trouble. This was not always, if ever, true, and scientists prefer to name such condition "psycho-neuroses," which indicates a disturbance of both the mind and the nervous system. Some years before the war an Austrian psychologist named Sigmund Freud studied cases of hysteria in great detail and propounded the theory that they were due to suppressed desires of a sexual nature. This belief is generally known as "Freudianism." When physicians try to cure disease through mental treatment they call it "psycho-therapy."

Its Use to the Teacher

Psychology has also been found useful in education, for what has been learned about memory, thinking, instinct, learning, and intelligence, effectively aids teachers in their plans and methods of work. Wherever teachers are trained they study "educational psychology" just as doctors study anatomy and physiology. One of the important recent advances in this field is the development of scales for the measurement of the intelligence of school children. These scales for the measurement of intelligence and other scales for the measurement of achievement in school subjects are making possible greatly improved methods of teaching (*see* Intelligence Tests).

The expression "applied psychology" is frequently used to designate one or all of the special efforts to use psychological knowledge in connection with medicine, education, business, industry, and law. Applied psychology is the general term, whereas educational psychology, for instance, indicates a more limited portion of the field. Probably the most conspicuous effort to apply psychological knowledge to practical life was in connection with the United States Army in the World War, when nearly two million men were examined by means of intelligence tests to determine their mental fitness for army service.

Psychology and the Business Man

Similarly, what we have learned about the motives which make men behave in certain ways are great aids to business men in effective advertising, and what we have learned about special aptitudes is of some advantage to employers in selecting workers, and to workers in finding the job at which they can do their best work. "Business psychology," which is the name generally given to these studies, is newer than educational psychology, but will undoubtedly be one of the most important fields for psychological study in the future.

There is also the field of "social psychology," which gathers together all the facts which are peculiar to human beings when they live in groups. Social psychology which attempts to understand the motives and forms of group conduct is exceedingly important to commerce and industry, to education, to politics, and to religion, and to the proper understanding of international affairs. In the latter field, a particular form of social psychology known as "racial psychology" is necessary to enable nations to understand one another.

Psychology in various ways is useful to law and to courts of justice. The credibility of witnesses and the responsibility of criminals are frequently matters of the mental conditions of such witnesses or criminals.

It may be said that the real study of psychology is hardly begun. There is much yet to be learned and the increasing complexity of modern life seems to force an extension of psychological study. Its promise of revelations is as inviting as that of any field of physical science.

The ancient Greeks were the first people to write in a systematic way about psychology. More than 2,000 years have since passed, and many men in many different countries have studied and written in a systematic way on the subject, so that what we now know about the human mind fills many volumes.

The modern students of psychology are numerous, but three names stand out above all others. These names are William James (1842–1910) of Harvard, Wilhelm Wundt (born 1832) of Leipzig, and Alfred Binet (1857–1911) of Paris. James is best known by two volumes entitled 'Principles of Psychology'. published in 1890, which "defined the boundaries of a new science (psychology) with unapproachable genius." Wundt's great contribution to psychology was the development of the experimental study of mental life and of the laboratory method. He established a psychological laboratory at Leipzig about 1879. The name of Binet is connected with the early efforts to develop scales for the measurement of intelligence. It is in these three countries, America, Germany, and France, that the subject has attained its most conspicuous development, and from these three men flow most of the major modern efforts to develop the study of psychology into a science.

In American colleges the subject has received increasing attention since 1890. Today almost every important institution in this country has not only its department of psychology but its psychological laboratory as well.

PTOLEMY (*tŏl'ĕ-mĭ*). Among the most trusted generals who accompanied Alexander the Great on his conquests in Asia was a Macedonian named Ptolemy, who became one of the seven body-guards attached to that king's person. After Alexander's death (323 B.C.), Ptolemy received Egypt in the division of the spoils of empire, and ruled that country for 38 years. He was the founder of a line of Greek rulers there, of whom the last was Ptolemy XII, the brother of and joint ruler with the famous queen Cleopatra. After her death, in 30 B.C., Rome took over the rule of the fertile kingdom of the Nile, and the Ptolemies as a ruling line came to an end.

About a hundred years later new honor was conferred upon the name Ptolemy by the famous astronomer, geographer, and mathematician, Claudius Ptolemaeus. What his relation was to the old royal house we do not know, for his descent, place and date of birth, and date of death are all unknown. But he was a native of Egypt and lived in Alexandria, and he must have died soon after 150 A.D.

As a mathematician Ptolemy is especially to be remembered as having written the first treatise on trigonometry, a branch of mathematics invented by Hipparchus. In astronomy he wrote a complete treatment upon the entire subject as known in his time, including the earliest known catalog of the stars. This volume, to which the name 'Almagest' ("the greatest") was later given by Arab scholars, remained the standard of astronomy until the time of Copernicus. Ptolemy's greatest mistake was in placing the earth in the center of the spherical heavens, and believing that sun, planets, and fixed stars revolve about it.

As a geographer Ptolemy accepted the old Greek view that the earth is a sphere, and he was the first to point out that the position of any point on the earth's surface can be accurately stated only after its longitude and latitude have been determined.

In addition to these works he wrote a volume on optics, in which he stated the correct laws of reflection for plane surfaces and for concave mirrors, as well as the law of refraction. Altogether Ptolemy must be considered as one of the earliest types of the modern scientific investigator and one who contributed greatly to the scientists who came after him.

PUBLIC UTILITIES. Most of the needs of any community are supplied by competing business enterprises, such as groceries, dry goods stores, hardware stores, drugstores, and theaters. But there is another very important group of businesses in which there can be little or no competition. Such businesses are street railways, waterworks, electric light and power plants, gas companies, and telephone and telegraph systems, of which there is usually only one system to a community. Such industries are called "public utilities" or "public service companies," because they furnish important services to the general public or to the community as a whole. Railroads and other transportation services are called "common carriers" and belong in this class.

In industries of this sort a customer seldom has a choice between a number of companies. He must take water service from the company whose water pipes are laid in his street, electric service from the company whose electric wires have been extended to his door. Public utilities are therefore natural or virtual monopolies. A monopoly is brought about in other industries by agreements between companies and consolidations (*see* Trusts). But a public utility is a natural or a virtual monopoly because conditions make competition impossible or undesirable.

Why They are Monopolies

These conditions are, first, high cost of plant and systems, as in the case of waterworks, street railways, electric companies, and other utilities. It does not pay to put in a number of these expensive systems in one community. Second, it is necessary for most public utilities to get special privileges (called "franchises") from the city or other public authority, such as the right to place their equipment in the public streets. This tends to keep out competition, because duplicating systems of tracks, gas or water mains, poles and wires for electric or telephone service, are undesirable and uneconomical.

Since the public does not have the advantage of competition in the case of public utilities, and since it has grown so dependent upon the utilities for important services, it is a matter of public interest that their prices be reasonable, and the service satisfactory and available to all without discrimination. The man who lives in a city today does not dig his own well but depends upon the public water system. Everyone expects the electric light company to furnish lighting service at any time a switch is turned. Suppose one of these companies should decide not to serve some or all of its customers. Suppose it should make a big increase in rates for its service. It might even choose to charge some individuals or business houses more than others, so as to give its friends an advantage over the others; or it might, for personal or political reasons, refuse to serve certain individuals. This is just what has happened in a great many cases, and the public soon came to realize the necessity of regulating these industries to see that continuous and satisfactory service was furnished without discrimination, and at reasonable rates.

In the early days when there was often only one blacksmith, innkeeper, or ferryman in a community these industries were really public utilities, and they were often regulated by the public authorities. As the great public service corporations of modern times grew up it was recognized that special administrative machinery must be devised to protect the people. In some cases the regulation is by the municipalities, by city ordinances, or by a city committee or commission appointed especially to look after the public interest in these matters; but most of the more important types of public utilities are controlled by state laws and state commissions. Every state in the United States, except Delaware, has one or more of these commissions, and for the United States as a whole the Interstate Commerce Commission has been created to regulate common carriers in matters affecting their service through more than one state. (*See* Interstate Commerce Commission.)

Government Ownership

Sometimes instead of simply regulating private companies furnishing these important public services, the local or national government may choose to own and operate the necessary plants and systems itself. For example, in most cities of the United States the waterworks systems are municipally owned and operated. Some cities also own and operate electric plants, street railways and other public utilities. The payment for the service from a municipal plant may come partly or wholly from the tax funds, or the city may charge the customers for the service just as the private company would do.

Because of the importance of the public service rendered by the railroads, there has been a strong movement for many years in favor of their purchase from the private companies by the national government and their operation as a branch of the government, like the railroads which the government owns and operates in Alaska, the Philippine Islands, and the Panama Canal zone. During the World War the United States took over the administration of the railroads to secure the greatest efficiency in the transportation of troops and war materials.

In Canada and the European countries public ownership is more common, and railroads, telephone and telegraph services, and other public utilities are government operated to a considerable extent.

PUEBLO (*pwĕb'lō*) **INDIANS.** In the arid regions of the southwestern United States there still live tribes of semi-civilized agricultural Indians—Hopis, Zuñis, Taos, etc.—who in the early days were named "Pueblo" Indians by the Spaniards from their habit of dwelling in stone or mud-brick "cities." The name pueblo, applied to these "cities," comes from the Spanish word meaning "village" or "people." There are 28 pueblos which are still inhabited, in addition to hundreds of ruined structures which formerly were populous centers. Among the most interesting are the now deserted habitations of the former "cliff dwellers," who are supposed to have been the ancestors of the present tribes. (*See* Cliff Dwellers.)

A Pueblo Indian drilling a turquoise.

The typical pueblo, developed from the primitive cliff dwelling, is often placed on the top of a lofty flat-topped hill, called a *mesa*. It is a many-roomed structure, of six or seven stories piled one upon another like a series of terraces, so that the roof of one building is the "front yard" of the next above. Ladders serve as entrances. Slabs of sandstone are used as building material, chinked with adobe or any handy substance; but most of the modern villages are built of sun-dried bricks.

The present-day Pueblo Indians are industrious farmers, and skilful potters, basket makers, and weavers, like their ancestors. Except for seven Hopi villages in Arizona and two pueblos in Texas, they all live in New Mexico. They are nominally Christian, though they still retain many of the primitive rites and customs. They number less than 15,000.

PULAS'KI, CASIMIR (1748–1779). Among the soldiers of Europe who aided the Americans in their struggle for independence was Count Pulaski, a Polish nobleman. In his own country Pulaski had taken an active part in the struggle to keep Poland free from Russian domination. The struggle had been unsuccessful, and Pulaski had been exiled in 1772. He had escaped to Paris, where he eventually met Benjamin Franklin, the American representative. Franklin persuaded Pulaski to aid the colonies in their struggle for freedom, and in 1777 Pulaski joined the American army.

He immediately distinguished himself at the battle of Brandywine, and for his bravery was commissioned a brigadier-general. He served for some time under Washington, and then was given permission to raise an independent corps which became known as "the Pulaski Legion." At the head of this force he successfully defended Charleston from an attack by the British in May 1779, but in an unsuccessful attack on Savannah, Ga., in October of the same year, he fell mortally wounded, and died two days later. Though he had been unable to preserve liberty in his own country, he had helped to win it for the new nation in the Western Hemisphere.

PULSE. The phenomenon known as pulsation (Latin *pulsus*, "a pushing" or "beating") is due to the distention of the arteries when blood is sent into them by the contraction of the heart. The pulse is usually examined at the radial artery at the wrist, the advantage of that position being that the artery is near the surface and easily compressed against the bone. The veins have, normally, no perceptible pulse.

The pulse itself is unimportant. It might be called a by-product of the fact that the heart beats rhythmically and the arteries are elastic. However, by studying the pulse the physician can learn something of the condition of the heart, blood-pressure, and blood-vessels; and these are very important things for him to know about.

The frequency of the pulse (which means, of course, the frequency of the heart-beat) varies with age, from 130 or 140 per minute in infancy to 70 or 75 in adult age. It also varies with sex, adult females having six or eight more beats per minute than males. It is increased by exertion or excitement, and is diminished by lying down or sleeping. In some diseases the pulse may reach 150 to 200 beats per minute; and, on the other hand, in certain organic affections of the heart, it may be as slow as 25 or 30. (*See* Blood; Heart.)

PUMA. Occasionally when forest rangers in the Rocky Mountains are riding back through the darkness to their lonely cabins, they are startled by a blood-curdling scream like the cry of a woman in mortal terror. It is the voice of the puma or mountain lion. Few persons, however, have heard the puma's cry, for it is the quietest of the cat family, and usually hunts silently, flitting like a shadow on the trail of a deer, or springing without a sound upon a strayed calf, colt, or sheep.

Next to the jaguar of South America, the puma is the largest of all American cats. Formerly it ranged from ocean to ocean, and from Canada to Patagonia. The early pioneers called it "panther" or "painter" and dreaded it as a fierce and treacherous beast. In the United States they have now disappeared from all but the wildest portions of the West.

Though the puma is a bloodthirsty killer of sheep and other small domestic animals, it becomes tame and docile in captivity. Puma kittens at birth are covered with spots and stripes, but these soon disappear to make way for the uniform reddish-brown color of the parents. When full grown pumas measure about 40 inches from the nose to the root of the tail, which adds another 25 inches or so to the length. Other names for the puma are American lion, catamount (also applied to the lynx), and cougar. Its scientific name is *Felis concolor*.

A POWERFUL BUT COWARDLY BRUTE

The Puma has a fierce glaring eye and muscles like steel, but it is so slinking and cowardly that few have been known to attack human beings.

PUMP. Each of us has one of the most marvelous pumps known—a beating heart—working away inside of him from the moment he is born. What is a pump? It is a machine for moving fluids, ordinarily for lifting liquids. Among the earliest and simplest devices made by men for the purpose were probably the well-sweep and the bucket raised by a rope over a windlass. The Persian wheel or *noria*—a wheel placed upright with the lower portion of the rim submerged in the water, and with buckets so hung all around the rim that each in turn, as the wheel revolves, dips up water and then pours it out on a higher level—is another primitive device. It has been improved into the chain-pump, in which the buckets are carried on an endless chain traversing two wheels, one down in the water and another on an upper level.

A much later invention is the suction pump, by which water is first pushed up through a tube by air pressure or suction (*see* Air), and then lifted by the bucket or plunger. From the pump-head down into the water runs an air tight tube. The pump-head is provided with a spout and a handle which by means of a plunger-rod works a plunger up and down in the tube. This plunger fits the tube closely; on its upper surface it carries a valve hinged to open upward. Fixed in the lower end of the tube is another similar valve.

When the handle is raised, pushing the plunger down, the pressure of the confined air opens the plunger valve but holds the lower or inlet valve shut. When the handle is forced down, raising the plunger and increasing the space between the two valves, a partial vacuum is created, and the pressure of the rarefied air within no longer balances the pressure of the air without. The weight of the outer air pushes the plunger valve shut and raises the water in the pump, opening the inlet valve. So by successive strokes the water is raised until it stands above the plunger, and is lifted to pour out at the spout.

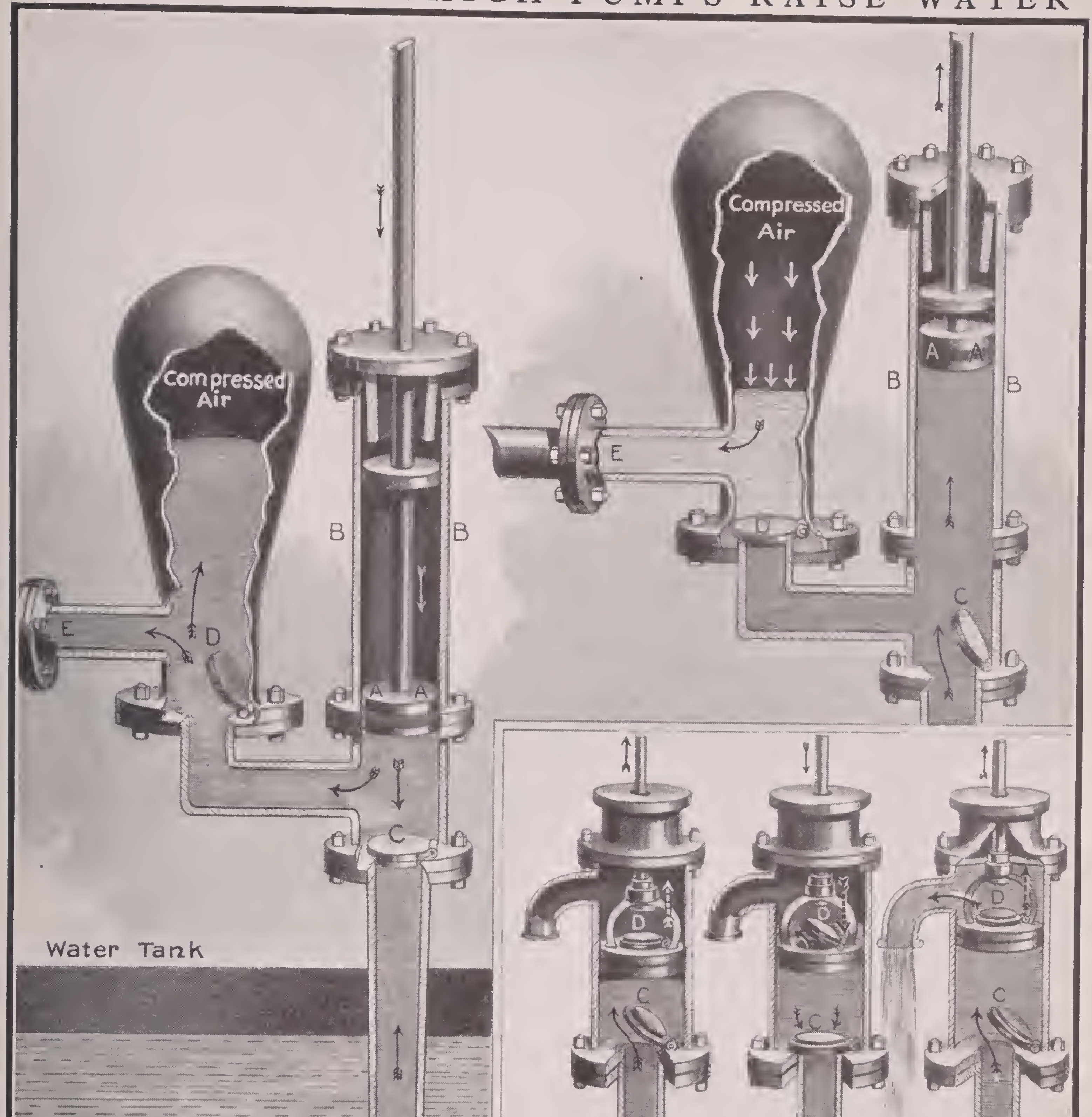
It is atmospheric pressure alone that raises the water until it passes the plunger valve. For this reason the suction-pump can raise a column of water only to a point at which the weight of the column is equal to the pressure of the atmosphere. This, at sea level, is about 32 feet; and because all pumps leak more or less the practical limit is about 25 feet. If water must be raised to a higher level, some other form of pump must be used. The simplest of these is the force-pump, which may be simply a suction-pump provided with a delivery pipe and a third valve, instead of a spout. Since the water above the plunger is lifted, not pushed up by the air, it may be lifted to any height by the addition of the third valve to prevent back-flow. An air cushion is commonly added to equalize the flow of water. When the plunger is lifting water, the air is compressed; when the plunger descends, the compressed air expands and presses the water up through the delivery pipe, thus securing a steady stream of water.

These pumps are wonderful inventions; but innumerable varieties of far more complicated pumps are now in use. There are many varieties of the force- and suction-pumps; many kinds of impeller pumps, including centrifugal pumps, aspirators, and injectors; impulse pumps or hydraulic rams (*see* Hydraulic Machinery); and many kinds of power pumps.

PUMPKIN. Pumpkin pie takes equal rank with turkey as a part of Thanksgiving dinner, for since the days of the earliest settlers, who found the Indians cultivating this big squashlike fruit in their fields of maize, the pumpkin has been a favorite article of food. The pumpkin vine grows to a length of 20 feet or more, and has large leaves, hollow prickly stems, and large yellow flowers. In America pumpkins are still planted as the Indians planted them, between the rows of corn. The fruit weighs usually between 10 and 40 pounds, but often attains a much larger size. Pumpkins turn from green to yellow as they ripen, and are ready to harvest only when other vegetation has been killed by the frost. Raw pumpkins are used for cattle food and to make "Jack-o'-lanterns" for Hallowe'en; they are also canned so as to give us pumpkin pie all the year round. In pioneer days they were sliced and hung in strings from cabin roofs to dry for winter use. James Whitcomb Riley has well celebrated the beauty of the days "when the frost is on the pumpkin and the fodder's in the shock." (*See also* Squash.)

PUNCTUATION. A misplaced comma once cost the United States government $2,000,000. In a tariff bill about 50 years ago the section enumerating what

TWO WAYS IN WHICH PUMPS RAISE WATER



The large left-hand drawing shows the downward stroke of the piston (A) in the barrel (B) of a force pump. Intake valve (C) is closed, and water is passing through the outlet valve (D) to the discharge pipe (E), and into the air chamber. In the upper right-hand picture an upward stroke is drawing water through the intake valve (C). The outlet valve (D) is closed and the air compressed in the air chamber by the last "down" stroke is maintaining the flow. In the pictures below the rising piston of a suction pump (1) is drawing water through intake valve (C). On the downward stroke (2) this valve shuts, and the piston valve (D) admits water to the cylinder. The next upward stroke (3) discharges this water and draws up more.

articles should be admitted free of duty specified "all foreign fruit-plants," etc., meaning plants for transplanting, propagation, or experiment; but a clerk in copying the bill changed the hyphen in the compound word "fruit-plants" to a comma, making it read, "All foreign fruit, plants," etc. The consequence was that for a year, until Congress could remedy the blunder, all oranges, lemons, bananas, grapes, and other foreign fruits were admitted free of duty.

Many a lawsuit has turned on the question of punctuation. One such occurred in France, where the disposal of $40,000 depended on the decision as to whether a small spot of ink was or was not a comma. For a less serious example, you know the nursery rhyme which reads, unpunctuated:

Every lady in the land
Has twenty nails on each hand
Five and twenty on hands and feet
This is true without deceit.

Now read the same properly punctuated:

Every lady in the land
Has twenty nails; on each hand
Five, and twenty on hands and feet;
This is true without deceit.

Another instance of the difference made by merely interchanging two marks of punctuation is the story of a member of a legislative body who had called one of his fellow members a liar, and was compelled publicly to apologize for the offense. He did so by rising in his place and saying: "I said he was a liar, it is true; and I am sorry for it." The apology was deemed sufficient; but in the newspaper next day the apology was printed thus: "I said he was a liar; it is true, and I am sorry for it."

The ancient Greeks and Romans did not have to bother about punctuation; in very early times they did not even separate the words in writing. But if you attempt to read one of their ancient manuscripts, you will realize how much easier it is to read a page that is properly punctuated.

Manutius, a Venetian printer of the 16th century, is generally regarded as the father of our present system of punctuation. Its principal marks are the following: the period (.), generally placed at the end of a sentence and at the end of abbreviated words; the comma (,), used to separate words, phrases, and sometimes clauses; the semicolon (;), used to separate clauses or divisions of a sentence requiring a more marked separation than is indicated by the comma; the colon (:), used where the sentences require a more marked separation than is indicated by the semicolon, as well as to introduce a series of particulars or a long quotation; the dash (—), generally used to indicate a break in the thought or a change in the structure of a sentence; the interrogation point (?), used to denote a question; the exclamation point (!), used to express surprise; the hyphen (-), used between the divisions of a compound word and to divide any word at the end of a line; the apostrophe ('), used as a sign of the possessive case and to supply the place of any letter or letters omitted from a word; the parentheses ( ), used to inclose explanatory matter; the brackets [ ], used to include the words or remarks of an author within the quoted writing of some other person; the double quotation marks (" "), used to inclose any word or words quoted from another person; single quotation marks (' '), used to inclose a quotation within a quotation and sometimes (as in this work) to indicate the title of a book, play, etc.

There are numerous rules for the use of these various points, but perhaps no two writers or printers would agree as to the proper mark to be used in all cases. Good judgment and taste, and a certain amount of practice, are essential to anyone who would punctuate in such a manner as to secure the fundamental object of punctuation—the correct expression of the sense. When in doubt about punctuation, ask yourself this question, "Is a comma or other point needed to make the meaning perfectly clear?" Remember that there is always a reason for every mark of punctuation.

PUPA (*pū'pȧ*). This is the third of the four stages through which an insect usually goes during its lifetime, the first two being the egg and the larva stages. At the close of the larva stage the insect fastens itself firmly to some object and generally builds a cocoon or case about itself, made of silk or some other substance produced by little glands in its own body. In this cocoon it sleeps, either entirely motionless, as though dead, or squirming a little only when disturbed. During this sleep great changes go on within the body of the pupa, so that when it comes out it is quite a different-looking creature from what it was when it began its pupal sleep. It has now become a full-grown insect, and usually has wings. This wonderful change in form can be best seen when a caterpillar goes into its cocoon and comes out a glorious butterfly or moth. The pupal stages of different insects are often called by different names. That of the butterfly is called the chrysalis. Only those insects which have what is called complete metamorphosis pass through the pupa stage. (*See also* Insects; Larva.)

PURE FOOD LAWS. To prevent the fraudulent use of substitutes in foodstuffs and drugs, laws against adulteration have been passed throughout the greater part of Europe, and the United States has regulations called "pure food and drug laws." The first law of this name was passed by Congress June 30, 1906, and new provisions have been added from time to time. Since the Federal government can only deal with merchandise shipped from one state to another, the separate states have similar regulations effective within their own boundaries.

The Federal food laws require that the labels on all standard foods shall tell if any foreign substance has been mixed with the genuine product. For instance, if fruit jellies are colored with artificial dyes, this fact must be stated so that the purchaser will know what he is buying. The use of common food names, like "butter," is not permitted on the package unless it contains butter actually made from cream. Whenever a preservative is put into a food or drug, this also must appear on the label. As most preservatives are more or less harmful, many are prohibited entirely, and others are limited to very small quantities (*see* Antiseptics). It is also illegal to represent that a food has been imported from abroad, if it is a home product. In fact, all improper or deceptive labeling is forbidden. Strict watch is also kept to prevent the sale of decayed fruits and vegetables, or of meat from diseased animals. What applies to foods and drinks also applies to drugs; when sold as standard products, they must be of standard strength and purity. Agents of the Department of Agriculture are in charge of enforcing the laws.

PURITANS. "I will make them conform or I will harry them out of the land." This was the threat that King James I of England made to the Puritans when they asked him to "purify" the state church of England of certain ceremonies and usages derived from the Roman Catholic church, which they disliked. These Puritans were not dangerous sectaries, but were just plain citizens of England—farmers, merchants, professional men, and scholars, especially from the University of Cambridge. They came to be regarded as gloomy fanatics, and it was humorously said that "they objected to bear-baiting, not because of the pain to the bear, but because of the pleasure to the spectators." The Puritans of the time of James I, however, were not afraid of innocent pleasure. Many of them were fond of music; the Puritan country gentlemen hunted; and the writings of one of the foremost Puritans, John Milton, have come down to us as a priceless literary heritage.

PURITANS ON THEIR WAY TO CHURCH

Going to church in New England in the early days wasn't a mere matter of getting up early enough on Sunday morning, for Indians might be lurking about anywhere. For years the settlers had to go in companies, as shown in this well-known painting by the American artist George H. Boughton.

The Puritans were the advanced wing of the Protestants in England in the days of the Reformation. The division began among the religious exiles from England who sought refuge on the Continent during the Catholic persecutions of Queen Mary's reign; and it became acute at Frankfort-on-the-Main in the quarrels between the "Knoxians" and "Coxians" (followers of John Knox and Dr. Richard Cox) over the wearing of priestly vestments. In general the Puritans inclined to follow the lead of Knox, Calvin, and the Swiss reformers, who would reject all usages of the Catholic church for which positive warrant was not found in the Scriptures, and would thus reduce the worship of their churches to the bare simplicity of Apostolic times. So arose their opposition to written prayers, religious images and pictures in the churches, instrumental music in the church services, and the like.

Some of the Puritans, instead of wanting merely to purify the church services, wanted to change the whole government of it as well. The Presbyterians, for instance, wanted to do away, "root and branch," with the government of bishops in the church, but would retain a state church. Others, called Separatists, or Independents, wanted the church and state to be entirely separated and each congregation to manage its own affairs; these were later called Congregationalists. Still more radical reformers called Anabaptists (or Baptists) thought baptism should be given only to adults, and held other startling views as to church and state.

It was a band of the Separatists who went first to Holland in 1608, and then to America in 1620, where they founded Plymouth Colony (*see* 'Mayflower'). James I and Charles I carried out the threat to "harry the Puritans out of the land," and thousands of others came to America, especially during the "Great Migration" of 1629–40. When the Civil War between the king and Parliament gave the control of the government into the hands of the Puritans, the emigration for a time stopped (*see* Cromwell, Oliver).

At the Restoration in 1660 the Puritans lost control of England, but the seeds of civil liberty and of a more serious outlook on life which they planted bore fruit in after-years. Not only greater freedom in religion but also greater freedom in government are among the things which we inherit from these Puritans, along with the literary works of Milton and Bunyan.

Since 1689, when a Toleration Act was passed, the English dissenting bodies have had a legal status, and today virtually no religious tests remain, except in the case of the crown.

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

PURITY

FAR back in the imagination of the world is the splendid figure of a man. He may never have lived; he may just be the child of another man's mind, for the mind of a man can dream things that can never come true in the life of a man. Yet this figure stands like a central glory in the great Past of the world. He is the everlasting figure of Purity, of singleness of purpose, of high and noble aim. He comes to us in story and in poetry; his eyes look out on the world from great pictures. His name was Galahad.

Lord Tennyson has told us the great story of the search for one of the world's lost treasures. The knights of King Arthur's court went out to search for the Holy Grail, the cup from which Jesus drank at the Last Supper on the night before the Crucifixion. Far beyond the evils of the world it lay, and sin could not come near it. Knight after knight came home without finding the Holy Grail; but at last one knight, whom no temptation turned aside, succeeded in the quest. It was Galahad—true, brave, and pure. He had gone out into the world with a single purpose; he had let nothing evil come into his life.

Be a Galahad. If you would find the cup that never fails, if you would have the peace that all desire, be a Galahad.

You may not ride through the world on a white horse to find the Holy Grail, but you may be a Galahad in the street, the factory, or the shop, at school or at home.

You are looking out into the world, as Galahad did; you have something to find, as Galahad had. Galahad succeeded where others failed, and his secret is ours. He sought the highest end by the noblest means. He gave his utmost for the best. He kept the great end in view. He set an ideal before him, and followed it with the devotion of a friend for a friend. Nothing small or mean could swerve him from his path. He put first things first; he did not sacrifice a great end for small considerations. Selfishness, the petty desire for praise, the fear of mockery—all these he left behind him.

And, whatever you do in the world, believe that there is no surer way to success than this. You may work so that all you do heaps up advantages for yourself, and leaves those who help you tired and joyless and poor. When you look back upon such a life, though you look back upon it in a palace, the looking back will bring you no peace. But you may work, instead, so that all you do heaps up advantage for yourself *and others;* and if you work like that, though you look back in a cottage, you will have a peace that nothing in the world can take away.

Set a great purpose before you. Follow it to the end. Let nothing mean or selfish or ignoble enter into your soul. Be brave, with the courage of David; be true, with the truth of King Alfred and George Washington; be pure, with the purity of the Maid of Orleans. Be a Galahad.

SIR GALAHAD

My good blade carves the casques of men,
My tough lance thrusteth sure,
My strength is as the strength of ten,
Because my heart is pure.
The shattering trumpet shrilleth high,
The hard brands shiver on the steel,
The splintered spear-shafts crack and fly,
The horse and rider reel.
They reel, they roll in clanging lists,
And when the tide of combat stands,
Perfume and flowers fall in showers,
That lightly rain from ladies' hands.

A maiden knight—to me is given
Such hope, I know not fear;
I yearn to breathe the airs of heaven
That often meet me here.
I muse on joys that will not cease,
Pure spaces clothed in living beams,
Pure lilies of eternal peace,
Whose odours haunt my dreams;
And, stricken by an angel's hand,
This mortal armour that I wear,
This weight and size, this heart and eyes,
Are touched, and turned to finest air.

The clouds are broken in the sky,
And thro' the mountain walls
A rolling organ-harmony
Swells up, and shakes and falls.
Then move the trees, the copses nod,
Wings flutter, voices hover clear;
"O just and faithful knight of God!
Ride on! the prize is near."
So pass I hostel, hall, and grange;
By bridge and ford, by park and pale,
All-armed I ride, whate'er betide,
Until I find the Holy Grail. —TENNYSON

Putnam, Israel (1718–1790). Israel Putnam of Connecticut stands as one of the most picturesque figures of the American War for Independence. He had early won a reputation for bravery by crawling into a wolf den and killing a wolf at close range. This reputation was heightened by his thrilling exploits in the French and Indian War. At one time he rescued a band of English soldiers from a numerically superior band of Indians; at another he escaped capture by the Indians by shooting some perilous rapids in a river; finally he was captured by the Indians and taken to Canada, where he was soon exchanged.

In the long period of disagreement between England and her colonies, Putnam's sympathies were entirely with the colonies. He served as chairman of the Connecticut committee of correspondence, and as such carried to Boston the contributions of the Connecticut patriots when the port of Boston was closed by English orders.

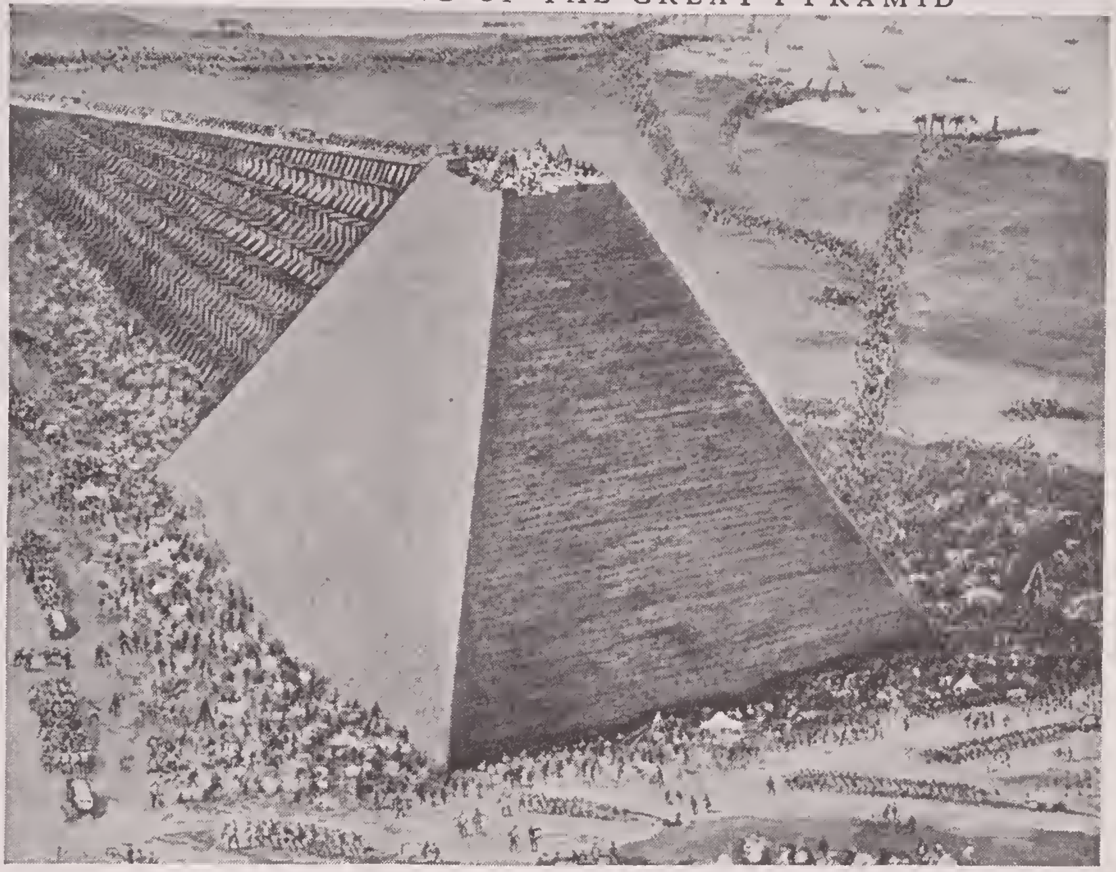
When the news of the outbreak of hostilities at Lexington reached him, he left his plow in the furrow, and hurried to Boston. For his conspicuous services at the Battle of Bunker Hill, he was commissioned a major-general in the Continental army. His services after the battle of Bunker Hill, however, were more picturesque than notable for their practical value. He had much personal bravery but was not a great general, as was shown by his unsuccessful leadership of the American forces in the highlands along the Hudson in 1777–78.

In 1779, two years before the close of the Revolution, General Putnam suffered a stroke of paralysis, and had to retire from the army. He lived to see the success of the cause to which he had given the best of his services, and died in the year following the inauguration of Washington as president.

Putty. The cement that holds our window-panes in place and keeps air from leaking in around the edges of the glass is called putty. It is used also for filling holes or cracks in woodwork, and is occasionally colored and molded into relief ornaments. "Jeweler's putty" is used for polishing metals, glass, jewelry, etc. Putty is usually prepared by mixing a form of powdered chalk called "whiting" with linseed oil until a tough dough is formed. When dry it becomes very hard and sticks tightly even to smooth surfaces.

Pyramids. For about 5,000 years the colossal tombs we call the Pyramids have reared their giant bulk from the hot sands of Middle Egypt, challenging the wonder and admiration of the generations. Built to protect the bodies of the Pharaohs until the Day of Resurrection, they have long since yielded up their secrets and the royal mummies have been plundered and scattered to the four winds of heaven. The polished granite and limestone slabs which once encased many of these monuments, concealing the entrance to the tomb chamber and making the sides impossible to scale, have been removed, but the ponderous interior structures, composed of rough-hewn blocks of stone or of brickwork, still stand as the greatest of all architectural achievements in point of massiveness. "Time mocks all things," says an Arab proverb, "but the Pyramids mock Time."

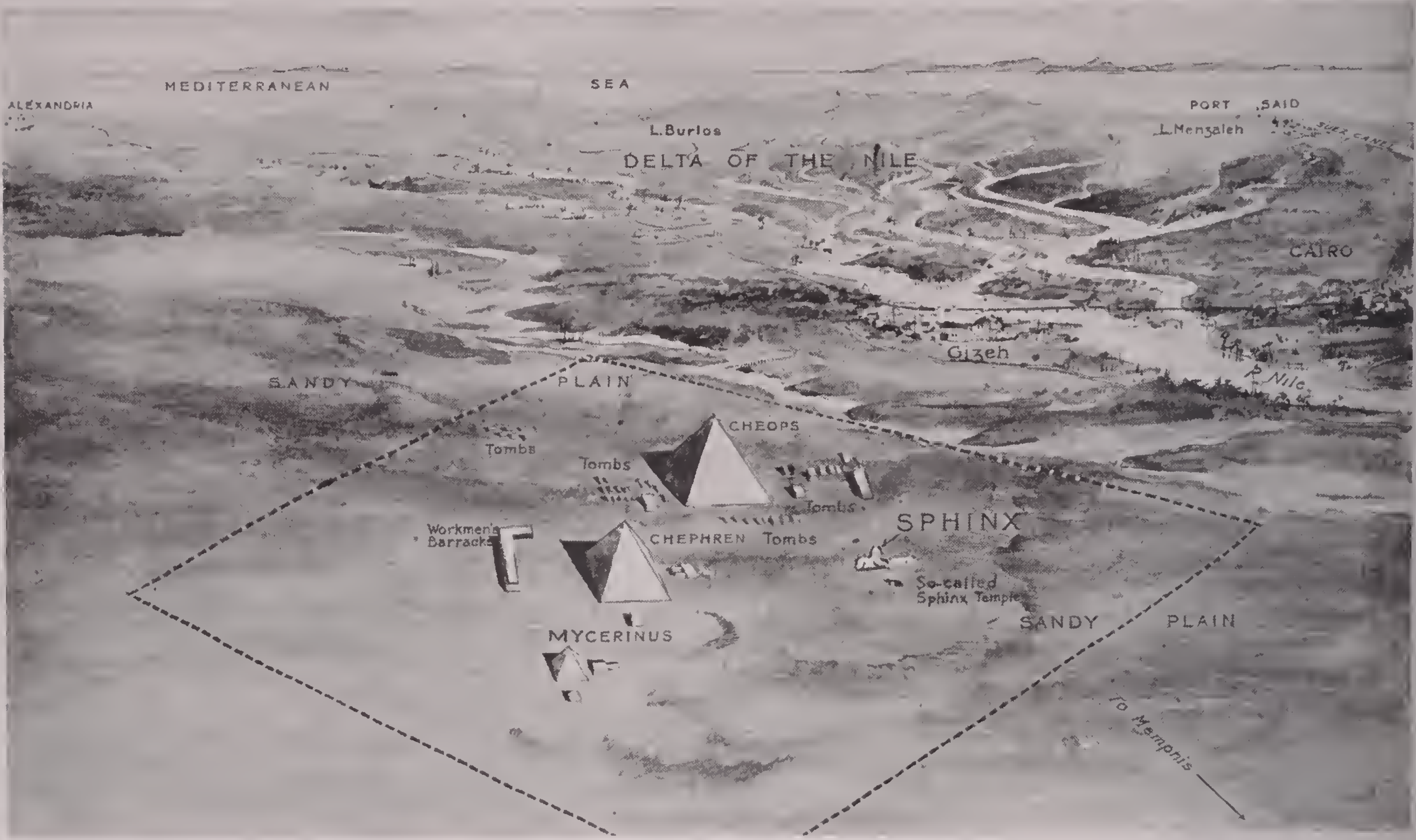
THE BUILDING OF THE GREAT PYRAMID



For twenty years the subjects of King Khufu in relays of 100,000 toiled under the taskmaster's lash, building the Great Pyramid as his monument. This large mass of brick and stone is the oldest of the ancient Seven Wonders of the World and, alone of them, survives. It is generally believed that the enormous stones were put in position by the aid of inclined planes, such as the artist has shown here.

These royal tombs of ancient Egypt number about 50 or 60 of all sizes. The best examples are the three great pyramids of Gizeh, built by the early kings of the Pyramid Age, probably between 2900 and 2750 B.C. The first or Great Pyramid, erected by King Khufu (Cheops) is 725 feet square at the base and rises to a height of 481 feet. It is so large that if it were hollowed out, St. Peter's Church at Rome could stand inside of it and occupy only about half the ground space. Its stones are enough to build a wall around France. The second, the pyramid of Khafra, is but little smaller; while the third, the pyramid of Menkaura, is only about half as large.

THREE GREAT TOMBS THE PHARAOHS BUILT



This bird's-eye view of lower Egypt looking down the Nile to the sea, shows the position of the Sphinx and the three pyramids of Cheops (Khufu), Chephren (Khafre), and Mycerinus on the wide and sandy plain across the river from Cairo. After Cheops had reigned his 50 years and his bones had been laid away in this vast tumulus, his brother, Chepren, who succeeded him, built the second pyramid; and then he died and was entombed. Next came Cheops' son Mycerinus, who erected the third and smallest of the series.

In the Great Pyramid the so-called king's chamber is located well up in the heart of the structure, connected with the outside by means of two air-channels and an entrance passage which leads downward from a point on the face of the pyramid about 47 feet above the foundations and then branches upward to the chamber by a concealed passageway. The main passageway continues downward, beyond the branching off of the passage to the royal chamber into the rock below the pyramid, where there is a chamber called the well. A third chamber is found in the heart of the pyramid, about halfway between the bottom and the king's chamber, connected with it; this is known as the queen's chamber. These halls and passages are all lined with polished granite and limestone, and show the marvelous ability and knowledge that the Egyptians possessed in contriving to support so great a weight of solid rock. (*See also* Architecture; Egypt.)

PYRENEES (*pĭr'ĕ-nēz*). Extending like a jagged and gigantic wall from the Bay of Biscay to the Mediterranean Sea, the Pyrenees form an almost unbroken mountain barrier between France and Spain. Bare, bleak, and rugged, the peaks reach a mean height of 5,000 to 6,000 feet, with many in the central portion towering to a height of 8,000 to 9,000 feet. Pic Néthou (Maladetta), the highest point in the range, is 11,168 feet high. On the hottest days of summer one sees on these peaks a crown of glittering snow and ice. From the lower tree and flower-clad slopes branch out deep green valleys, through which wind beautiful streams fed from cascades that dash madly down from the rocky heights. The passes that connect Spain with France by railroad and highway are located, the one at the eastern and the other at the western end of the chain. Between these are only two passes which are practicable for carriages. All other passes are so difficult that they are crossed only by rough mule trails, so narrow that two horses can barely pass. The boundary line of France and Spain follows along the central ridge. In the heart of the eastern end of the chain, in a deep fertile valley surrounded everywhere by rocky peaks, lies the tiny republic of Andorra, covering an area of less than 200 square miles.

Fewer tourists are attracted to the Pyrenees than to many other regions less beautiful, for the roads are very difficult and walking and sightseeing trips, if not impossible, are most fatiguing. There are practically no game or wild animals, the eastern mountains having been ruthlessly stripped of their former heavy forests, and lax fishing laws have robbed the streams of a once plentiful supply of mountain trout.

The mineral ores of the Pyrenees are not in general of much importance, though some iron mining is done. Some coal deposits capable of being profitably worked are found on the Spanish side. The inhabitants of the region are chiefly occupied in farming and stock raising, plentiful pasturage for cattle, sheep, and goats being found in the upland meadows.

PYROM'ETER. In tempering steel for tools in railroad tracks and cars, automobiles, and other important applications, it is necessary to measure exactly temperatures far above the boiling point of mercury. Ordinary thermometers are therefore useless for this purpose, and special instruments called "pyrometers" have been devised. Thermometers containing hydrogen or some other gas are sometimes used, but these gas thermometers are more for the laboratory, and not for practical use in most industries. Pyrometers are used not only in steel and other metallurgical work but also in many chemical processes and in such industries as making glass and pottery.

For most practical purposes, electrical pyrometers are used. There are two types of these. The first type, the "thermoelectric" or "thermocouple" type, depends upon the fact that if two wires or rods of different metals are in a circuit and one of the junction points of the unlike metals is heated, an electric current is set up. A galvanometer joined in the circuit measures the current, and the temperature of the hot junction can then be known from preliminary measurements with known temperatures. There are many combinations of metals that can be used, but copper, iron, nickel, or platinum are commonly used for one wire, and nickel or platinum alloy for the other.

The second type of electrical pyrometer is the "electrical resistance" pyrometer. This depends upon the fact that the resistance of a pure metal to an electrical current increases regularly when the temperature is raised. Platinum is usually the metal for pyrometers of this type, and the same metal is used for measuring not only high temperatures (over 3,000° F.) but also the very lowest temperatures, such as the temperature of liquid air (−310° F.).

Another type of pyrometer, called the "optical" or "radiation" pyrometer, depends upon the fact that the color and amount of light and heat radiated by a hot body varies with its hotness. The skilful blacksmith learns to tell from the color and brightness of the hot iron whether it is of the right temperature for working. In the optical pyrometer, the rough method of the blacksmith is made by science an exact method of knowing temperature by measuring the light and radiation from the hot body. Thus to get the temperature of a furnace, it is not necessary to put any wire or other body into the furnace, but simply to observe the furnace with this instrument. One form of the optical pyrometer looks like a small telescope. It contains a small electric lamp which can be changed in brightness by changing the electric current. The eye tells when the light from the furnace and the electrically heated filament of the lamp are the same. The temperature of the furnace can then be read directly from a prepared scale.

PYRRHUS (*pĭr'ŭs*), KING OF EPIRUS (about 318–272 B.C.). Among the many rulers of petty kingdoms who sought to gain power after the death of Alexander the Great, one of the most celebrated was Pyrrhus, king of the mountainous little country of Epirus, to the northwest of ancient Greece. A brilliant and dashing soldier, he was ambitious for glory and determined to found an empire in the West.

A quarrel had broken out between Rome and the Greek city of Tarentum in lower Italy. When the Tarentines applied for assistance, he gladly responded and crossed the Adriatic with about 25,000 troops and a number of war elephants. The forces met at Heraclea near the Tarentine coast and there a bloody battle was fought (280 B.C.). The Romans were terrified by the elephants, which they had never seen before, and Pyrrhus won the day. But his loss was so great that he is said to have exclaimed after the battle, "Another such victory and we are lost!" Thus arose the expression "Pyrrhic victory," which we still use of a victory so costly that it is little better than defeat. After another "Pyrrhic victory" at Asculum, he withdrew to Sicily.

Here, in aiding the Syracusans against the Carthaginians, he saw another opportunity for conquest. At first he met with brilliant success, but he soon lost popularity. He returned to Tarentum, where he met final defeat at the hands of the Romans in the battle of Beneventum (275 B.C.). Returning to Greece, Pyrrhus engaged in various military enterprises, but failed to realize his ambitions. He was almost on the point of gaining the Macedonian crown which he so much desired, when, having been called to Argos to help settle a political quarrel, he was struck by a tile thrown from a roof and killed.

PYTHAGORAS (*pĭ-thăg'ō-rȧs*) (about 582–500 B.C.). One day seeing a dog beaten and hearing him howl, the Greek philosopher Pythagoras bade the striker cease, saying: "It is the soul of a friend of mine, whom I recognized by his voice." This remark, which is the only saying of Pythagoras recorded by his contemporaries, illustrated his belief that at death the soul passes into another living creature, a man, an animal, or even a plant. This belief in the "transmigration of souls" has been widely held by primitive peoples and has even passed over into some highly developed religious systems, especially in the East. It was part of the teaching of Buddha and it is held by many millions of people today. (*See* Buddha.)

Pythagoras was a great traveler and is said to have spent 30 years visiting various countries about the Mediterranean Sea. About 529 B.C. he settled in Crotona, a Greek city of southern Italy, and founded a religious brotherhood bound by vows of sobriety and self-control and to the observance of certain mystical rites. The order spread rapidly in the neighboring cities, but won the hatred of the people because it became entangled with politics. Mobs sacked the houses where the Pythagoreans met and killed many members of the order. Whether or not Pythagoras perished in this outbreak remains unknown. The brotherhood was never revived, but the teachings of Pythagoras were widely held in Greece and Italy until the middle of the 4th century B.C.

Our chief interest in the Pythagoreans is due to the fact that they made many important contributions to the sciences of mathematics and astronomy. They discovered the important fact that "the square of the hypotenuse equals the sum of the squares of the other two sides of a right-angled triangle" (*see* Geometry). They also found out that the length of a musical string is in exact relation to the pitch of its tone. They were the first to teach that the earth is a globe, revolving with other planets around a central sun. These mathematical discoveries so fascinated the Pythagorean thinkers, and the new science of numbers seemed such a wonderful and important thing to them, that they held that numbers were the very substance of the universe, and declared that "all things are numbers."

PYTHON. When you go visiting the animals at the zoo, be sure to pay a call on the python, that powerful gigantic snake who belongs to the same family as the boa, and whose real home is found in the tropical parts of Africa, Asia and Australia. The one you will see there will probably be the reticulated python, the largest serpent of the Old World and the only rival of the anaconda for first place in the snake kingdom.

A sleepy looking fellow he seems here, as he proudly coils up his handsome yellowish brown body (sometimes 30 feet long) marked in a black lozenge pattern and glittering in the sunshine with many hues. But he is savage enough in his native regions of Indo-China and the Malay Islands. Perhaps he is dreaming now of his homeland amid a hot moist jungle, where he could creep through tangled underbrush, climb great forest trees, and swim in tropical streams with equal ease. And perhaps he remembers how at nightfall he would creep out of his hiding places in rocky holes and shady tree-tops and, hanging motionless from trees, or lurking in grass or water, he would wait for his prey. Woe to the birds, small deer, and other animals who then came down to the water-hole for a drink! With a pounce, the python would wind himself around his victim, and crush him with his terrific strength, and roll him into a compact sausage-shaped mass. Then, opening his well-toothed loosely hinged jaws (that can manage anything not larger than a goat) he would devour his meal so slowly that—if it were a good-sized one—he would not care for another for several weeks! Despite savage tales there are few trustworthy records of these giant snakes attacking human beings.

Pythons grow slowly—probably living to a great age. The female lays about a hundred eggs which she collects in a heap, coils around, and, taking a two months' fast, guards until they hatch. On the equatorial west coast of Africa pythons are venerated by certain tribes who keep them in their temples.

These very large and powerful snakes belong to the genus *Pythonidae* of the family *Boidae*, and there are several species including the brown light-spotted "royal python" often seen in menageries (*Python regius*) and the small species found in southern Mexico.

Q

QUAIL. Have you heard of the bird that pays the farmer's taxes, clears his land of weed-seeds and insects and furnishes a tasty dish for his table as well? It is the pretty little "bobwhite," the best known of the American birds, that we call "quail." But the quail of the Old World belong to an entirely different family.

It is because of the high esteem in which the bobwhite is held as a game bird that he is able to pay the farmer's taxes. Every fall nearly half a million sportsmen go out from the cities to shoot quail, and for this privilege they pay considerable sums, often more than the year's taxes on the farm. So highly valued is the bobwhite that in many states preserves are established where the birds may multiply. The state stocks a farmer's land with colony of quail on condition that he will allow no hunting for an agreed period. In nearly every state the open season is restricted to only a few weeks, to prevent the extermination of the birds.

FRIENDS OF THE FARMER

Wide awake looking chaps, aren't they, those two California Quails with their knightly crests? Below is a Mrs. Bob White and her children.

Bobwhite is often called a partridge, but he insists on the name he has given himself. If you have been in hearing distance you will not forget it, for he tells and re-tells it—*Bob, Bob White! Bob White!*—with an emphasis that fastens it forever in the memory.

There are several species of American quail, varying in size from 9½ to 11 inches long. The plumage is generally of mottled brown and buff, so like the shades of fallen leaves and grass that a quail often protects itself by lying quiet against the ground, where sometimes even a hunting-dog will pass it by. (For illustration in colors *see* Birds.)

The mates are devoted to each other and to the large family of a dozen or more hatched in the ground nest hidden among shrubbery, stubble, or under an old stump. When the young leave home they wander about in a family party, and when scattered their call, usually so cheery, takes a plaintive tone until the covey is reunited. These birds do not migrate, and often when the ground is covered with snow they have to depend entirely on the farmer for their food.

The California quail, found in the humid districts of the Pacific coast, is 11 inches long and wears a crest of black. Gambel's quail and Mearn's quail are smaller birds, found in the southwestern parts of the United States and Mexico.

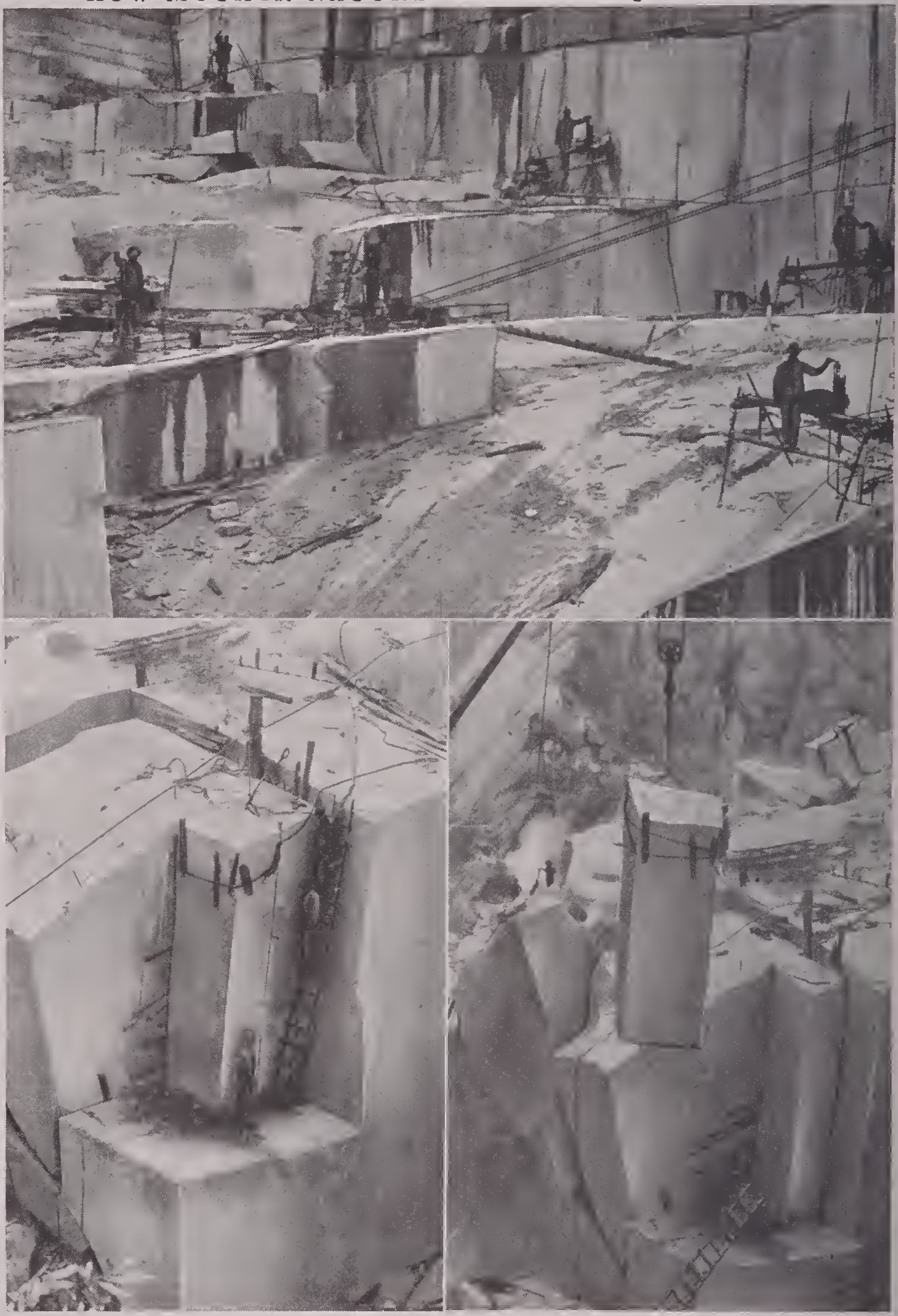
The true quail, found throughout Europe, is about seven inches long. During autumn these birds migrate to Asia and Africa and at this season great numbers are netted for the market. Scientific name of the bobwhite quail, *Colinus virginianus.*

QUARRYING. Throughout the centuries quarrying of stone has been done with hand tools, as it still is to some extent; but machines operated by steam and electric power are now common, especially in the United States. A visitor to a modern quarry finds "channeling" machines chugging back and forth on their short tracks cutting furrows in the solid rock, enormous cranes and derricks swinging huge blocks from place to place, and light railways laid here and there on the rough quarry bed to haul out the stone and carry off the strippings and refuse. Occasionally there is heard a mighty explosion, followed by a shower of splintered rock, and always the air is filled with the unmusical sound of thudding drills and heavy hammers wielded by brawny arms. Rectangular masses of stone weighing many tons are loosened from the mother rock, great cranes swing them onto cars, and these are carried to the stone mill. There swinging gang saws, with diamond tipped teeth and under the constant drip of water, cut the stone into slabs of desired thickness almost as if it were wood; while lathes and planing machines turn roughly fashioned pieces into columns, cornices, and lintels, and give them the finish that the architect calls for.

Rocks are divided into two kinds—stratified and igneous—according to whether they occur in parallel beds or have no distinct lines of cleavage. The stratified or sedimentary rocks, which include marble and other limestones, slate, and sandstone, are the more easily quarried. Granite and other igneous rocks, however, although not stratified, have a natural jointing of which advantage is taken in quarrying. Much skill is needed to know just where the rock will separate most easily.

The "plug and feather" method of quarrying is the one principally employed in working by hand. A row of holes is drilled a few inches apart along the line at which it is desired to break the stone. In each hole are placed two "feathers"—flat pieces of steel rounded on one side to fit the curve of the hole. Then a narrow wedge called a "plug" is driven between the "feathers." By striking in succession all the plugs in the row, the splitting force becomes great enough to rupture the rock. This method is often used also in machine-worked quarries to separate large blocks after they have been cut vertically by the steam-driven "channeling" machines. Explosives, placed in holes drilled vertically in a row then exploded simultaneously, are commonly employed for detaching large blocks of stone. High explosives, such as dynamite, are often used when the rock is to be crushed into fragments for road work, concrete making, etc.

HOW MOTHER NATURE HELPS THE QUARRYMAN



As if Nature had meant the stone to be quarried, she frequently divides up rock masses as she has done in this Vermont marble quarry. First come the horizontal divisions, made in the laying down of the strata in the rock mills of the sea ages ago. Later come the vertical divisions made by the cracking of the rock when the earth's crust was upheaved or depressed. Thus great blocks can often be separated by merely driving in wedges, as you see in these pictures.

The channeling machine, which has found its greatest use in the United States, is like a small locomotive traveling back and forth upon a short track which is pinned to the solid rock. As it travels it strikes on one or both sides of the track with sets of long chisels set at different angles; these vibrate up and down cutting a channel about 1½ inches wide and 4 to 10 feet deep, parallel to the rails on which the channeler moves. Since the channeler makes only vertical cuts, the rock must later be lifted from its bed by blasting or the "plug and feather" method.

There are 4,000 stone and marble quarries distributed widely throughout the United States. Eighty per cent of the building limestone of the country comes from two counties in Indiana, near Bedford and Bloomington, where beds exist 30 to 40 feet in thickness. The even texture, strength, and easily workable quality of this oölitic limestone have made it a national favorite for building and also for finely chiseled statuary. Much limestone is also produced in Ohio and Pennsylvania, though the latter is used chiefly for flux in the iron industry. The United States stands second to Italy in the production of marble, most of which comes from huge beds in Vermont, in which state is also to be found the largest marble-finishing plant in the world.

Stone is used principally for building, monuments, paving and curbing, and in crushed form for roads, concrete making, and railroad ballast. Much limestone of inferior quality is used in making lime and in charging iron furnaces. Slate forms a distinct industry by itself.

QUARTZ. The two most abundant and widely distributed chemical elements, oxygen and silicon, combine to form the most abundant of all minerals, quartz or silicon oxide (SiO_2). The "igneous" rocks —those which once were molten masses—contain from one-third to four-fifths quartz. As the water-laid or "aqueous" rocks are made from materials obtained by tearing down either igneous rock or organic matter, so they too are likely to contain quartz, which is one of the most resistant of stones. Most sand and pebbles consist of broken-down and water-worn fragments of crystalline quartz (*see* Sand); and sandstone and puddingstone are the same materials built up into rock again. Sometimes neighboring particles of sand are cemented together by an accretion of silica and form a dense mass of vitreous rock. Such rock is known as "quartzite."

Quartz is hard enough to scratch glass, but not as hard as diamond, sapphire, or topaz. It occurs in non-crystalline masses (flint, jasper, agate, etc.), and also in six-sided, pyramid-headed crystals, clear as water when pure, but often beautifully colored by impurities (*see* Crystals). The Greeks named the transparent quartz *krystallos*—whence our word "crystal." Rock crystal or transparent crystalline quartz has many uses in making optical instruments, being preferred to glass for many purposes. The colored varieties of quartz include many beautiful semi-precious stones, such as agate, amethyst, aventurine, bloodstone, cairngorm, carnelian, cat's-eye, chalcedony, chrysoprase, jasper, mocha stone or moss agate, onyx, rose quartz, and sardonyx.

OLD FRANCE *in* NEW CANADA

Extent.—North to south, greatest distance, 1,200 miles; east to west, 1,350 miles. Area, 707,000 square miles. Population, about 2,400,000 (French-speaking, about 2,000,000).

Physical Features.—Rolling country and Notre Dame Mountains (highest point, Sutton Mountain, 4,000 feet) south of St. Lawrence River; level lowlands of St. Lawrence valley; densely wooded Laurentian Highlands (1,000 to 2,000 feet) occupying all the remainder of the province. Lakes: St. John, Mistassini, Minto, Payne, Clearwater, Seal, Apiskigamish, Melville, Memphremagog, and many others. Chief rivers: St. Lawrence and its tributaries Saguenay and Ottawa; Nottaway, Rupert, Great Whale, and Koksoak tributary to Hudson Bay and Strait; Hamilton to the Atlantic.

Products.—Corn, hay and other forage, oats, barley, wheat, tobacco, apples, and other fruit; maple sugar and syrup; cod and other fish, lobsters; live stock, butter and cheese; asbestos, cement, copper, etc.; lumber and timber; refined sugar, textiles, pulp and paper, tobacco and cigars, fur and hats, shoes and leather goods, machinery, railway cars, etc.

Chief Cities.—Montreal (775,000 population), Quebec (capital, 120,000), Maisonneuve (40,000), Hull, Sherbrooke, Three Rivers.

QUEBEC (*kwē-bĕk′*), CANADA. If you were suddenly dropped into the Province of Quebec, the oldest and largest of the Canadian provinces, you might almost believe that you were in France. Most of the people are of French descent and they have preserved their language, their Catholic religion, and their customs. But the province is much larger than France, occupying all of the great peninsula of eastern Canada lying between Hudson Bay and the Atlantic Ocean, save for the narrow Labrador strip along the Atlantic coast. Its area, which was doubled in 1912 by the annexation of the immense northern territory then known as Ungava, is almost equal to the area of France, Belgium, Spain, Sweden, and Norway combined. Nearly 2,000,000 of the people, or 80 per cent of the population, are French. During the century and a half that these peasant-farmers have been a part of the British Empire, they have kept themselves separate from the English-speaking population. Even when they intermarry with other races, it is the others who lose their identity, as in the case of the Indians, Irish, and Celtic Scotch, who have been absorbed.

Most of these French-Canadians live along the St. Lawrence River. The strip of 50,000 square miles which lies south of the river, the "Eastern Townships," was originally inhabited in part by descendants of English Loyalists who fled from the United States at the time of the American Revolution, reinforced by subsequent immigrants from Britian and the United States. To the north the land is a great sparsely inhabited plateau, dotted with many lakes and bearing immense forests of red pine and spruce. This is the region which makes lumbering the second most important industry of Quebec; here, too, are to be found most of the mineral deposits—iron, copper, silver, gold, mica, molybdenite, and graphite. The famous mines which furnish two-thirds of the world's supply of asbestos are in the region south of the St. Lawrence.

But the leading industry of the province is agriculture. This is carried on very differently from farming on the great plains of the central provinces, for most of the farms in the older cultivated districts of Quebec are small, and they are frequently not more than 30 rods in width, stretching back perhaps a mile in length from the river or road on which they front. This brings the houses close together and makes the countryside one of the most picturesque in the New World, appearing as a long line of small white houses, with curved red roofs, and ribbon-like strips of land stretching away behind. The chief reason for this curious arrangement of the land is that the Frenchman is socially inclined and likes to have people near him.

On these fertile farms the French-Canadian families, which often number from 10 to 14 children, raise hay, potatoes, oats, barley, with some wheat, and corn near Montreal. In the country around Montreal one of the principal crops is a strong-smelling variety of tobacco, which is grown in nearly every farm and garden.

AN ASBESTOS MINE IN QUEBEC

This is one of the mines in southern Quebec, near Black Lake and Thetford, which provide the world's principal supply of asbestos. The crane scoops out the asbestos rock, and swinging around lowers it into cars, to be taken to the breakers.

On some farms may be found orchards of apples, pears, and plums, but most of the fruit, especially the famous snow apple, with its scarlet skin and snowy meat, is grown near Montreal and in the "Eastern Townships," where are also large stock farms and dairies producing each year millions of dollars' worth of butter and cheese.

In the cities also—notably in Montreal, the largest city, and in Quebec, the capital—the French predominate, but the industries—the shoe factories, lumber mills, iron works, pulp mills, wool and cotton factories, and the railroads—are chiefly in the hands of the Englishmen or the canny Scotch.

The province has a bracing and healthful climate, with long cold winters rendered tolerable by the dryness of the air. The winter sports of Quebec and Montreal are famous and attract thousands of visitors every year. In the north the average temperature for the year is about 12 degrees lower than in the south. The St. Law-

A WOOD PILE READY TO BE TURNED INTO NEWSPAPERS

What a wood pile! Spruce logs, cut into lengths of two to four feet, are here piled up ready to be ground into pulp for paper. A large amount of the pulp for American newspapers is imported from Canada, and England also gets much of its paper from the same source. Quebec stands first among the Canadian provinces in output of wood pulp.

A FINE HERD OF QUEBEC CATTLE

Stock raising is one of the important industries of Quebec, and on much of the land neighboring the New England states stock raising and dairying are more extensive industries than farming.

rence, the gateway to Canada, and a magnificent system of smaller rivers and lakes abound in picturesque and noble scenery, and are of great economic importance, furnishing cheap transportation routes and limitless water-power.

The province maintains an excellent system of public schools. The elementary schools are administered by a council of public instruction, which is divided into two committees, one to manage the Roman Catholic schools and one for the Protestant institutions. Each taxpayer may choose to which group of schools his taxes will go, and the government grants are divided between the groups on the basis of population. There are three large universities, McGill, Montreal, and Laval.

The province of Quebec has a long and romantic history, beginning in 1534, when Jacques Cartier entered the St. Lawrence River. Its settlement dates from 1608, when Champlain founded the city of Quebec. For more than a century and a half the province remained under the dominion of France and was known as New France. England finally obtained possession of it by the victory of Wolfe over Montcalm, in 1759 (*see* French and Indian War).

At times the existence of this "nation within a nation" has led to serious difficulties. In 1837 there was a short-lived rebellion of French-Canadian peasants under the leadership of Louis Joseph Papineau. The rebellion failed, but it led in 1841 to the establishment of a united Canadian parliament for the provinces of Quebec and Ontario, or, as they were then known, Upper and Lower Canada. This arrangement continued until 1867, when the present Dominion of Canada was formed. The old racial feeling reasserted itself to a certain extent during the World War, when political agitators inflamed some of the ignorant elements to threaten resistance to the conscription law passed by the Dominion Parliament. But the French bishops and leading statesmen were at one in condemning this movement, and the province took a notable part in contributing to Canada's splendid achievements at home and in the field.

POWER TO TURN A MILLION WHEELS

We are here looking at the Shawenegan Falls 70 miles northeast of Montreal in the River St. Maurice. This river has a remarkable flow of water, and the power derived from these falls, which are one of the largest in the river's course, helps to grind up into pulp and later to make into paper such spruce logs as those shown in the picture on the opposite page.

Historic Quebec, the Sentinel of the St. Lawrence

QUEBEC, CITY OF. Few cities of the New World can vie in romantic charm with the city of Quebec. As the traveler approaches on the bosom of the majestic St. Lawrence, he first sees the frowning mass of Cape Diamond upreared against the sky. Long dark lines ridging the summit, 333 feet above the river, betray the position of the massive fortifications of its citadel.

As the visitor comes nearer, he sees that the city is built in two sections—an Upper Town, separated by massive walls about half-way up the bluff, and the quaint old Lower Town, with straggling streets fringing the water front on a narrow strip below. The frowning city walls (Quebec is the only walled city in America) and the ancient cobblestone buildings of the Lower Town make it look like a city of medieval France, dropped down on the banks of the St. Lawrence. The resemblance is heightened when one enters the city, for nine-tenths of the inhabitants are of French origin, and French is the language of everyday life.

No other city north of the Rio Grande preserves unchanged so many features of the life of a bygone age. Wherever you turn you see nuns and priests in the costumes of two centuries ago, and the pupils of the seminary still wear the long blue coat piped with white, with green sashes. The picturesque horse-drawn *caleche* or light carriage and the sleigh in winter have not yet entirely given way to the automobile; and the *habitants*, or French-Canadian peasants, who throng the markets still live and dress much as did their forefathers.

QUEEN OF NEW WORLD CITIES

"Unexampled for picturesqueness and magnificence of position on the American continent, and for the romance of her historic associations, Quebec sits on her impregnable heights a queen among the cities of the New World.

"At her feet flows the noble St. Lawrence, the fit highway into a great empire, here narrowed to a couple of miles' breadth. From the compression of the great river at this spot the city derives its name. On the east of the city, along a richly fertile valley, flows the beautiful St. Charles, to join its waters with those of the great river. The mingled waters divide to enclasp the fair and fertile Isle of Orleans.

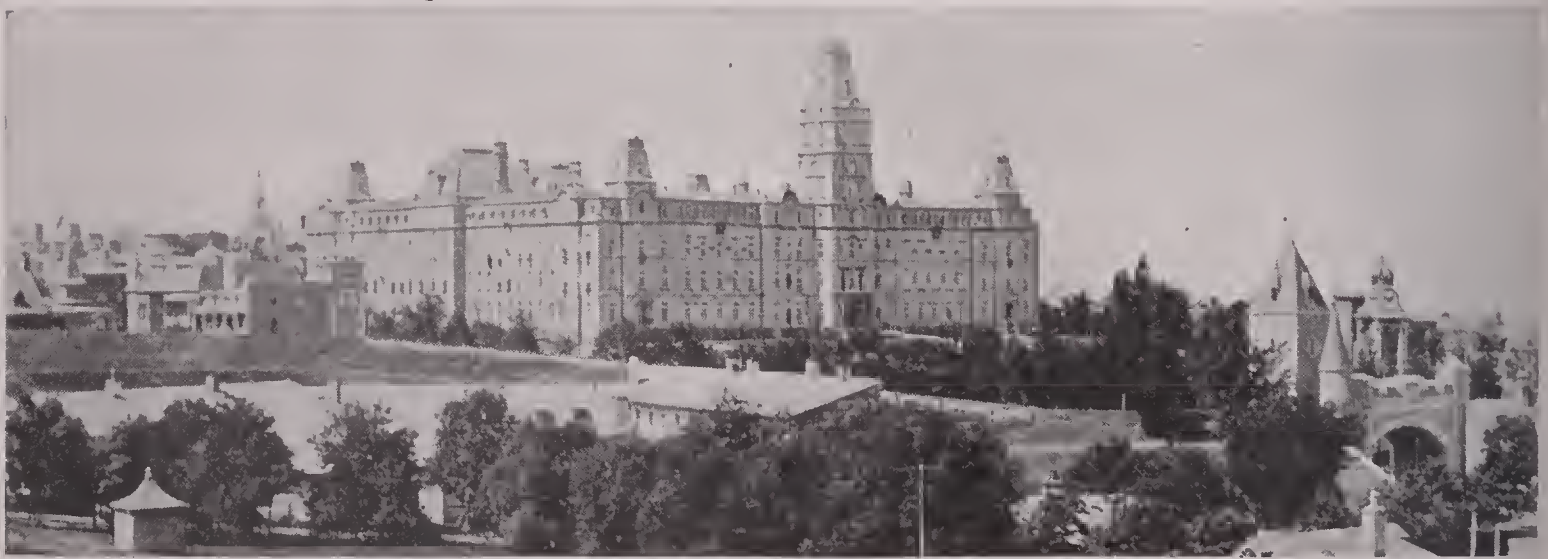
"The city, as seen from a distance, rises stately and solemn. Clustering houses climb the rocky heights. Great piles of stone churches, colleges, and public buildings, crowned with gleaming minarets, rise above the mass of dwellings. Above all rise the long dark lines of one of the world's famous citadels, the Gibraltar of America."

—CHARLES MARSHALL.

The Upper Town contains the more fashionable shops, residences, parks, churches, and fine public buildings. Conspicuous among the latter are the buildings of the provincial parliament and various government departments, for Quebec is the capital of the province which bears the same name. For 150 years of French rule and upward of 30 of British dominion it was also the capital of Canada. On the heights are the seminary of Quebec and Laval University, the seat of French learning and culture in the New World. Some of the seminary buildings date from the latter half of the 17th century. Many splendid old churches and convents, famous for their treasures of paintings and relics, remind the visitor of the religious zeal which played so large a part in winning the New World for civilization. The Basilica or French Cathedral, dedicated in 1650, is one of the oldest places of worship in the Dominion. In the nave of the Ursuline Convent chapel (1639) repose the bones of the Marquis de Montcalm.

Much of the commercial life of the city still centers in the narrow strip of land at the foot of the cliff. Steep and winding streets, flights of stairs, and an elevator connect the two parts. Along the water's

WHERE QUEBEC PROVINCE MAKES HER LAWS



The Parliament Buildings of Quebec are worthy of the great province they adorn. They are situated on the Grande Allée, one of the principal thoroughfares of Quebec, notable for its fine buildings, and are surrounded by extensive and attractive grounds. They form a square, 300 feet on each side, with towers at the corners.

MAGNIFICENT CHATEAU FRONTENAC ON DUFFERIN TERRACE

One of the most magnificent hotels in all the world is the Chateau Frontenac, built in the style of a French chateau, on Dufferin Terrace in the city of Quebec, overlooking the picturesque St. Lawrence River.

edge are miles of wharves and docks, for Quebec was long the chief port of Canada. It is not the commercial center that it once was, however, for the western development of the country transferred most of the export trade of the province to Montreal. But now, as the ocean-going vessels increase in size, it becomes more difficult for them to ascend the river, which at Quebec narrows to about a mile in width, and this is bringing some of the commerce, especially in lumber, back to Quebec. The great passenger liners also tend to make Quebec their terminus.

An Eventful History

Quebec is rich in memories of the shadowy past, beginning with the visit of the navigator Jacques Cartier, in 1535, who found several tribes of Indians encamped there. Nearly 75 years later another bold Frenchman, Samuel de Champlain, founded the first settlement below the commanding heights, which became the stronghold first of French power in America, and later of British. Quebec finally passed into British hands after the memorable campaigns in 1759 (*see* French and Indian War). One of the historic spots visited by every traveler is the Plains of Abraham, where a monument commemorates the heroic Wolfe, who fell in the hour of his victory. In the Governor's Garden is a common monument to both Wolfe and the no less heroic French commander Montcalm, who received his death wound within a few minutes of his rival. British genius for government is nowhere better revealed than in the liberty which has been allowed to the French people of this ancient city and the province, by which they retain their language, religion, and customs, remaining as a bit of old France in the heart of British Canada. Population, about 120,000.

QUEENSLAND, AUSTRALIA. The entire northeastern portion of Australia, 670,500 square miles, is included in this state. The population is extremely scanty, about 738,000, or slightly more than one person for every square mile. Ninety-three per cent of the area is still the property of the Crown, though part of it is leased for grazing. Only about one acre out of 400 is under cultivation. Corn, wheat, and sugar cane are the most important crops. Copper, gold, coal, and other minerals are mined, and considerable quantities of timber are cut from the immense forests which cover much of the state; but lack of labor has prevented the adequate development of these abundant resources.

More than half of Queensland lies within the tropics. The winter, which is practically rainless, is about as warm as an English summer. The summer, when the heavy rains occur, is considerably warmer, but extremes of temperature are practically unknown. Most of the northern coastland is tropical forest, with luxuriant palms, tree ferns, bamboo, and screwpine. Pineapples, bananas, and other tropical fruits are raised. Farther inland, where rainfall is scanty, are the grassy lands with their famous sheepwalks and cattle-runs. More than a third of the cattle in Australia are in Queensland, and the dairying industry is rapidly growing. Manufactures are still of comparatively little importance. Brisbane, the capital, with a population of more than 180,000, is the only city of any considerable size. It is an important shipping point and is the seat of a university established in 1911. (*See* Australia.)

QUEENSTOWN, IRELAND. In Cork harbor, in the middle of the south coast of Ireland, Great Island rises abruptly from the water. Built like an amphitheater on its steep southern side is the city of Queenstown, its handsome streets rising like terraces one above the other. Owing to its mild climate the island is a favorite summer and winter resort, and the shores are dotted with country residences and resort villages. The city owes its importance chiefly, however, to its being a port of call for mail steamers. It is also a naval station, and a government emigration station, and has large government dockyards and fortifications. The town first became important in the wars with America and Napoleon, when it began to be used as the port of embarkation for troops going on foreign service. Before that time it was a mere fishing village known as Cove of Cork. In 1849, in honor of Queen Victoria's visit to Ireland, its name was changed to Queenstown. A famous yacht club, the Royal Cork, has its headquarters at Queenstown, and holds an annual regatta. Population, 8,000.

QUINCE. Although a favorite fruit for jellies and preserves, to which it lends a delightful flavor, the quince when raw is bitter and puckery to the taste. The common quince (*Cydonia vulgaris*) is a much-branched shrub or small tree, closely related to the apple, with large white or pink flowers resembling apple blossoms, followed by hard golden-yellow apple- or pear-shaped fruit. It is widely cultivated in various parts of the Northern Hemisphere. In the United States the best orchards are found in New York state. It is native to Persia and Anatolia, and possibly to Greece. It was familiar to the ancient Greeks and figured in their mythology. Representations of it are found in Greek statuary.

The Japan quince is grown in gardens for the beauty of its flowers, which vary from creamy white to rich red. The fruit is green and fragrant, but uneatable.

QUININE (*kwī'nīn* or *kwĭ-nēn'*). In 1638 the Countess of Cinchon, wife of the governor of Peru, lay grievously ill with malarial fever. She was cured by means of a native Indian remedy, prepared from the bark of a certain kind of tree, which from her name we now know as the "cinchona." The knowledge of the curative properties of its bark was gradually spread throughout Europe, largely by returned Jesuit missionaries; and today the quinine prepared from it is one of the important remedies of every country.

By quinine we usually mean the sulphate of quinine. This is obtained by treating the powdered bark with lime, then alcohol, and neutralizing it with sulphuric acid. Other chemical salts of quinine are hydrochloride and hydrobromide of quinine, the first being produced by the use of hydrochloric and the second by hydrobromic acid.

There are about 40 species of cinchona trees, but only about a dozen of these are used to make quinine. In their wild state they grow in small clumps in the dense forests of South America; and collecting the bark which is done by the Indians is a work of much difficulty and some danger. To increase the supply of bark and prevent the disappearance of the tree, cultivated cinchona plantations have been established in Java and Ceylon, and throughout wide areas in British India.

R

RABBIT. This term in popular usage is applied indiscriminately to all members of the genus *Lepus*, both hares and rabbits. Strictly speaking, however, the name belongs only to certain European species which, unlike the hares, live in colonies or "warrens" with extensive underground burrows, and bring forth their young blind and hairless. In appearance also they differ in certain respects from the hares. The American hares, including the "jack-rabbit" and the cottontail, are generally called rabbits. Whereas the jack-rabbit is unquestionably a hare, the little cottontail has certain characteristics which ally it more closely with the rabbit. (*See* Hares and Rabbits.)

RABELAIS, FRANÇOIS (*rä-bē-lā'*, *frän-swä'*) (1493?–1553). The hearty, jibing, racy, and often most improper laughter of this famous French humorist rings in our ears even now, down four centuries of time. While pretending to tell a fairy tale about the adventures of two giants, Gargantua and Pantagruel, Rabelais makes huge fun of the vices and foolishness of the people about him, and of abuses within the church. His humor is at times so shocking, and his stabs at the church so deep, that it is hard to believe that he was almost all his life a member of the clergy.

Rabelais became a brother of the order of St. François in the convent of Fontenay-le-Comte in western France, about 1519, and pored over so many great volumes and learned so many strange languages that the other monks began to fear and suspect the young wiseacre. They charged him with heresy, and in wrath he whisked his monk's robes out the door and down the dusty highway, which led him on a long vagabondage. Though he still wore his pious costume and retained it all his life, we next find him at Montpellier—in the south—studying medicine, lecturing in the university there, and, in 1530, becoming physician of the hospital. And it seems doubtful if the church would any longer have influenced more than his costume, if he had not about this time won the friendship of Jean du Bellay, later made a cardinal. When Bellay went to Rome in 1534, Rabelais was a member of his retinue; the pope's pardon was granted him for his abrupt departure from the monastery; and later, also through the good offices of Bellay, he was given "livings" in the Church of France which lifted him above the fear of want. During a period of religious persecution in 1547, he fled to Metz, and as physician gained a humble fame among the poor. In 1552 he published his fourth book about Pantagruel, resigned his living and went to Paris, where he died the next year, murmuring, "I go to find the great *Perhaps*."

The precise year of Rabelais' birth is not known. In his half-vagabond life he made the acquaintance of every tramp and trudging workman along the road, of the great men of the church, and of the king and his court. From such a life was distilled the wide sympathy with all men, the rowdyism, the cleverness, the liveliness which make his writings still read today.

Rabelais' great satire 'Gargantua and Pantagruel' was published in sections, the first of which appeared in 1533; the complete edition was first published in 1567. He also edited various works, including 'Medical Letters of Giovanni Manardi' (1532); a reprint of the 'Aphorisms' of Hippocrates (1533); 'Last Testament of Lucius Cuspidius' (1533); 'Marliani's Topography of Ancient Rome' (1534).

RACCOON. This interesting animal is a relative of the bear, though it is much smaller and does not greatly resemble the bear except in its manner of walking, which is "plantigrade"—that is, with the hind feet resting flat on the ground. It is found in North America, especially in the southern part of the United States and along the Pacific coast. A species called the crab-eating raccoon is also found in parts of South America.

The common "coon" of the United States has a stout clumsy body, about two feet long without the tail, which is about a foot in length. The long coarse hair of the body is grayish-brown, and the tail is ringed with black and white. The head is broad with a pointed muzzle, and the face is crossed by a dark band which includes the eyes.

The home of the animal is usually high up in the hollow of a large tree; here it rests by day and hibernates through the severe winter weather. It is active at night, and during the season of young corn is very destructive to the green ears. Besides corn, its usual food is fish, crawfish, and various mollusks, though it also eats mice, insects, fruits, small birds, and eggs.

The raccoon makes an interesting pet, for it is intelligent and full of a restless curiosity that makes it examine every strange object with interest. A favorite trick is to search the pockets of its young master for nuts and other bits of food.

In early pioneer days raccoon fur was much used for coats, carriage robes, and especially the famous "coon-skin" caps on which the tails were often left hanging. This fur became less popular afterward, though it is now again come into fairly extensive use. Scientific name, *Procyon lotor*.

TALES THE WOODMAN TOLD

MR. COON WHO WOULDN'T CHANGE HIS MIND

"How would you like to have me tell you a story?"
HAZEL FRAZEE

LITTLE Boy had made up his mind to catch a fish. And he'd made up his mind to catch it down by the end of the Minnow Pond where the water was deep. Of course, the Woodman Who Was Wondrous Wise had warned Little Boy that the water was too muddy there, and that no fish would stay in such muddy water. He had told him to go up to the other end where the creek comes in and where it is so clear you can see the crawfish trying to hide under the stones.

But Little Boy just knew that there must be bigger fish where the water was deepest. So for two days now, ever since he had been given that nice shiny bamboo rod for a birthday present, he had been coming down and sitting there on the bank, watching the cork on his line. But never once did that cork bob, except when some old frog came paddling by, making waves like a tiny steamboat.

The Woodman Who Was Wondrous Wise was mending a fence back by the cow pasture, and every once in a while he'd call out:

"Changed your mind yet, Little Boy?"

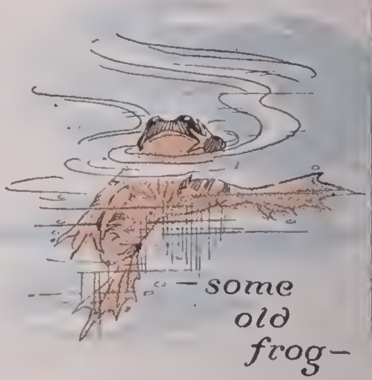
And Little Boy would reply that maybe the sun was too bright, or that perhaps he didn't have the right bait, or that the frogs were scaring the fish away. Away deep down in his mind he was beginning to feel that perhaps the Woodman was right, after all. But Little Boy was rather "set in his ways," as people say, and so he kept right on watching that cork.

Finally, toward the end of the second day, the Woodman finished mending the fence and came to the pond. He sat down beside Little Boy and said:

"How would you like to have me tell you a story, Little Boy, while you go on fishing?" Little Boy said he would like it very much, and settled down to listen. But he still kept his eyes on the cork.

"Once upon a time, not so very long ago," began the Woodman, "there lived in a tree not so very far away from here, a family of Raccoons. There was Father Coon, and Mother Coon, and five Little Coons—all as happy as could be. All day long they slept peacefully, and at night Father and Mother Coon went out to hunt, leaving the five Little Coons safe in their big hollow branch. There were frogs and fish and crawfish to scoop up out of the creek and the pond; there were sleepy grasshoppers to catch in the meadows; and sometimes, over in the fields, there was sweet green corn to nibble. Old Father Coon was very fat and looked very wise—and indeed he had a right to look wise, for many were the dogs he had outwitted and outfought in his long coon life.

"But there was one peculiar thing about him. He was mighty set in his ways. Now, Little Boy, it's mighty hard to judge about people who are set in their ways. If they win out in the end, we call it determination—which is a very fine thing. But if they don't win out, we sometimes feel that they are just plain stubborn. Old Mr. Coon was famous for his determination. When he started anything, he always stuck


—some old frog—

to it in his own way until he finished it.

"Well, he got along all right, as I say, until one night not so very long ago. It was just such a night as last night, with the moon shining down through the trees and playing along the creek until it was almost as bright as day. Mother Coon and Old Father Coon were down by the bank scooping up crawfish with their paws. You know, a coon's paw is just about the size and shape of your hand. He can pick things up like a monkey, and he's as quick as a cat. So Father Coon and Mother Coon had no more trouble dining on crawfish than you'd have eating peanuts out of a bag.

"After they'd eaten all they could and had about decided to go home to the children, something on the other side of the creek caught Old Father Coon's eye. As usual, he was just as full of curiosity as he could be.

" 'What's that?' he whispered in coon language, nudging Old Mother Coon, and pointing with his nose to where this thing glittered on a big flat stone.

" 'That's nothing but an old bottle', said Mother Coon. 'Don't you be going over there, now. It's time we were going home.' Old Mother Coon was rather inquisitive herself, but she thought she could hear the five Little Coons calling to her back there in the big tree.

"But Old Father Coon had made up his mind to investigate, for he was one of those who believe in finding out things for themselves, and not trusting much to what they hear. So he pushed by Mother Coon, jumped in, and swam across to that rock.

—grasshoppers to catch in the meadows—

"Sure enough, there it stood—an old milk bottle. But there was something down inside of it, he couldn't make out what.

" 'Hey, mother', he called. 'Come over here and see what this is. My eyes aren't as good as they used to be'.

—safe in their hollow branch—

"Mother Coon grumbled a little, but she came on over and looked down into the bottle and sniffed.

" 'Why, that's nothing but a crab-apple', she said. 'Come on, it's time to go home.'

" 'But what do you suppose that crab-apple's doing in that bottle?' said Old Father Coon, sitting back and cocking his head on one side, as he always did when he was thinking.

" 'How should I know?' said Mother Coon. 'Chances are somebody put it in there and went away and forgot it. Who cares about a crab-apple, anyhow?'

"But Old Father Coon had started stroking his whiskers in that wise way he had, and Mother Coon knew it was useless to argue with him, so she sat down to wait. Old Father Coon cocked his head on the other side and gave his whiskers a few more thoughtful strokes. Then he walked around the bottle three times, looking through the sides. Then he stopped and peeked down through the neck, and scratched his head. Then he tapped the bottle with his claws. Then he took hold of it and rocked it back and forth,

—the frogs were scaring the fish away—

He pushed by Mother Coon and jumped in

so that the crab-apple rolled around. Finally, he carefully squeezed one paw down inside and took hold of the crab-apple.

"'Yes, sir', he said, 'that's just what I thought. It's a real crab-apple all right. There's no trick about that.'

"He started to pull it out, but his paw stuck fast.

"It won't take me long now"

"'That's funny', he said. 'I can get my paw in all right, but I don't seem to be able to get it out.' "'Let go of that crab-apple and it will come out easy enough', said Mother Coon.

"'But that's what I reached in for—to pull the crab-apple out; and now you want me to let go of it. Don't be unreasonable!' And Old Father Coon looked at Mother Coon with great disapproval. He squeezed and he tugged and he turned and he twisted, but still his fist stuck fast. He rolled the crab-apple around and grabbed it from every side and every angle, but he simply couldn't get it out. Every few minutes he'd stop and think and stroke his whiskers with his free paw, then set to work again. Suddenly he had an idea. He let go with his right paw and stuck his left paw in the bottle and grabbed the crab-apple. But that didn't do any good. Then he went over and sat down with his back against an old log, and held the bottle braced tight with his back paws, while he squeezed and tugged and twisted all over again.

"At last Mother Coon lost patience and went home to the five Little Coons. But Old Father Coon stayed behind wrestling with his bottle.

"'It won't take me long now', he told her. 'You run on home, I'll be along pretty soon.'

"Why, that's nothing but a crab-apple"

"But when the sun rose, Old Father Coon was still sitting against the log, trying first one paw and then the other, and every once in a while stopping to squint up at the sky and think. You see, Little Boy, he was set in his ways."

The Woodman Who Was Wondrous Wise stopped. Slowly he got up from the bank of the pond and turned to go. Little Boy looked up disappointed. He had forgotten all about the cork that wouldn't bob, and he wanted the end of the story.

At last Mother Coon lost patience

"But why doesn't he tip the bottle up?"

"Please, Mr. Woodman," he said eagerly, "what happened to Old Father Coon? Is he there yet?"

"Pull in your line," replied the Woodman, "and come along. I'll show you."

The two walked through the woods to the Woodman's cabin. And there in a wire-covered pen sat a big Raccoon. He was leaning against the side with one paw inside a milk-bottle holding on to a crab-apple, while he squinted up at the sky.

"There's Old Father Coon, for you," said the Woodman. "You see I set that bottle out there last night, and Old Father Coon was easy to catch with that hanging to his fist, for, of course, he wouldn't let go."

"But why," asked Little Boy, "doesn't he tip the bottle up and pour the crab-apple out?"

The Woodman looked at Little Boy for a moment with a twinkle in his eyes. Then he answered in a most knowing way:

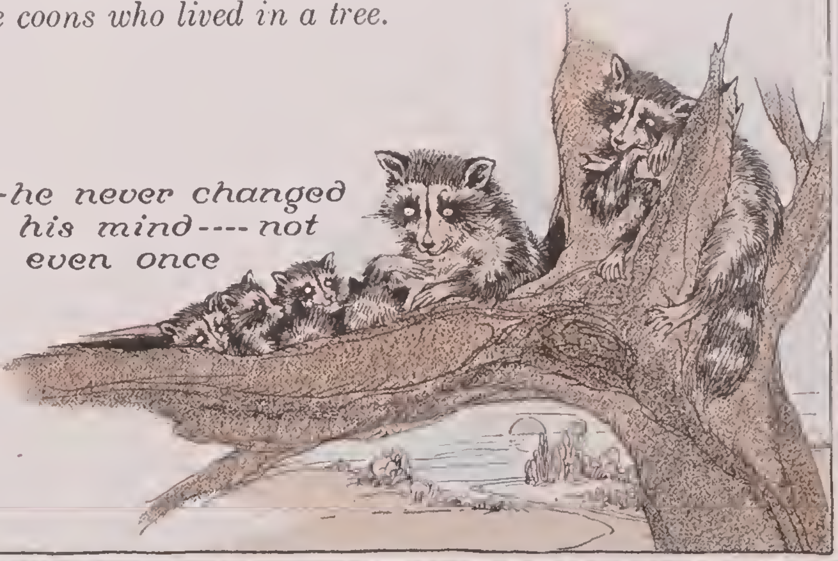
"Oh, Mr. Coon, *he* never changes his mind."

The next day when Little Boy was going out with his rod, he met the Woodman Who Was Wondrous Wise.

"Before you start fishing today," said the Woodman with a big smile, "go over and take a look at Old Mr. Coon." Little Boy didn't say anything, but went on and threw his line in the pond up where the water is clear and you can see the crawfish trying to hide under the stones.

And Old Mr. Coon!—Why, they say his paws got so thin from his sitting around with nothing to eat that he finally managed to pull the crab-apple out, or maybe the crab-apple got all withered up, so it came out easily. Anyway, he's back in the hollow branch telling the five Little Coons how in his whole life he never changed his mind—not even once.

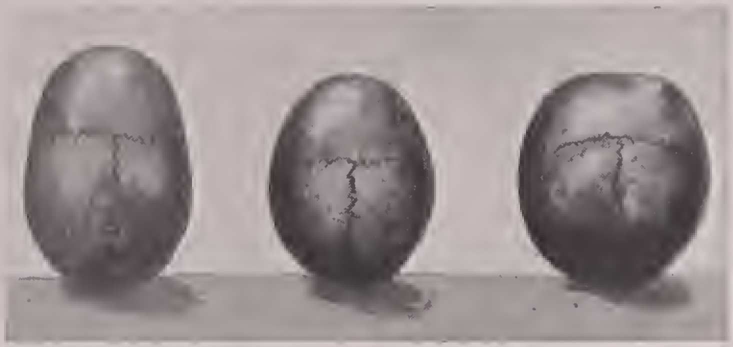
There was an Old Coon who lived in a tree,
And he was as happy as happy could be;
For he had a good wife, had this happy Old Coon,
Who helped him to hunt by the light of the moon;
And five little cubs who sat up in bed,
And listened with interest to all that he said.
"What a marvelous, wonderful father have we!"
Said the five little coons who lived in a tree.



—he never changed his mind---- not even once

RACES OF MANKIND. The 1,700,000,000 inhabitants of the earth present such a bewildering variety of characteristics that the attempt to classify them into a few main divisions or races is one of great difficulty. Many schemes of classification have been proposed, based on geographical distribution, language, physical characteristics, and habits and customs. Modern ethnology (as this branch of knowledge is called) for the most part bases its classification on physical characters alone, and considers a race as a permanent division of mankind having a common biological inheritance as indicated by the shape of the skull, the facial angle, the color of the skin, the form and color of the hair, the shape of the facial features, the stature and proportions of the bones, etc.

THE THREE TYPES OF HEADS



The shape of the skull is an important factor in distinguishing races. The three main types are shown here, from left to right, *dolichocephalic*, *mesocephalic*, and *brachycephalic*.

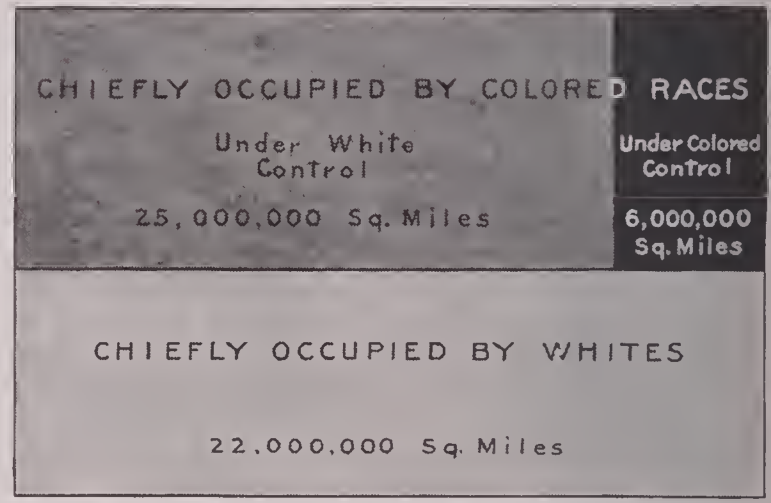
The most obvious of these race-characters and the one used in the common grouping of mankind into the white, black, red, yellow, and brown races is the color of the skin. In subdividing these largest groups, however, it becomes necessary to use other physical characteristics as well. Perhaps the most important of these is the shape of the skull, especially with reference to the ratio between its breadth, viewed from above, to its length. This ratio, which is called the "cephalic index," can be roughly determined from the shape taken by a man's hat which has been worn long enough to conform to the shape of the head. Multiply the width across the inside of the hat by 100, and divide by the length, and you have approximately the "cephalic index." If the result is 75 or less, the wearer of the hat is *dolichocephalic* or "long-headed"; if it is between 75 and 83, he is *mesocephalic*, or "medium-headed"; if it is more than 83, he is *brachycephalic*, "shortheaded," or "round-headed." Another important character is the "facial angle," which is the angle made by the bones of the face and forehead with the base of the cranium, viewed from the side. One of the most striking facts brought out by modern ethnology is the progressive increase of the facial angle—that is, from a sharp or acute angle to one approaching a right angle—as we pass from the lower animals to the apes and monkeys, and thence through the lower to the higher types of mankind.

On the basis of these and other physical characteristics most leading ethnologists have come to the conclusion that the white peoples of Europe are derived from three primitive races: (1) a Mediterranean race, extremely long-headed, rather short and slender, dark-haired, and of dark complexion; (2) the Nordic or Teutonic race, also long-headed, very tall, blue-eyed, and blond; (3) the Alpine, broad-headed, of short or medium stature, gray-eyed, brown-haired, and of medium dark complexion. The existing peoples of Europe, according to this view, are the result of a mixture of these three types, which are nowhere found in pure racial strains. The Scandinavian countries and northern Germany represent the greatest purity of the Nordic or Teutonic stock; the Slavic peoples and the typical stock of Switzerland and central France, that of the Alpine stock; and the inhabitants of Spain, Portugal, southern France, southern Italy, and Greece, that of the Mediterranean stock.

This and similar classifications based entirely on physical characteristics have largely superseded the older classifications based on language, which divide the peoples of Europe into three great families, the Indo-European, Semitic, and Finno-Tartaric or Turanian (*see* Philology.)

In grouping mankind as a whole, so many classifications have been proposed, varying widely according to the qualities taken as the test, that for most purposes it is convenient to retain the old classification based on geographical distribution and color of the skin. According to this scheme men fall into five main groups: (1) the Caucasian, European, or white race; (2) the Ethiopian, African, or black race; (3) the Mongolian, Asiatic, or yellow race; (4) the American (Amerind) or red race; (5) the Malay and Polynesian or brown race. Often this classification is still further simplified by including the American and Malay races in the Mongolian division.

THE SUPREMACY OF THE WHITE RACE



Less than one half the world is inhabited by the white race, yet the whites control nearly nine-tenths of its area.

One of the most amazing facts of history has been the world-wide expansion of the white race during the four centuries between 1500 and 1900. At the end of the 15th century the white race was confined to about 2,000,000 square miles of Europe, while the remaining 51,000,000 square miles of the earth's land area (excluding the polar regions) was possessed by the "colored" races. At the end of the 19th century, the area predominantly populated by whites was

BLACK, BROWN, RED, YELLOW, AND WHITE

Here we have an African negro, a Malay chief, an American Indian, a Chinaman, and a White Man, whom you recognize as Ben Franklin. These five represent the five great color divisions of mankind. In the modern classification of races, however, color does not play so important a part as formerly.

22,000,000 square miles, against 31,000,000 square miles for the colored races; while all but 6,000,000 square miles of the colored population areas was under white political control. In other words, the white races, comprising about one-third of the globe's population, held nine-tenths of its area. (*See* Population.)

How long will the white man continue to be master of the world? This is a question which political observers have been raising with increasing gravity ever since the emergence of Japan among the great world powers. There is growing unrest among the colored peoples under white domination, and there is arising a real sense of racial solidarity among the non-whites. The shock of the World War of 1914–18, the spectacle of the white peoples locked in deadly civil strife, intensified the feeling throughout Asia and Africa that the day of white supremacy was nearing its close. The gravity of this problem is heightened by the fact that the colored races are increasing in number far more rapidly than the white.

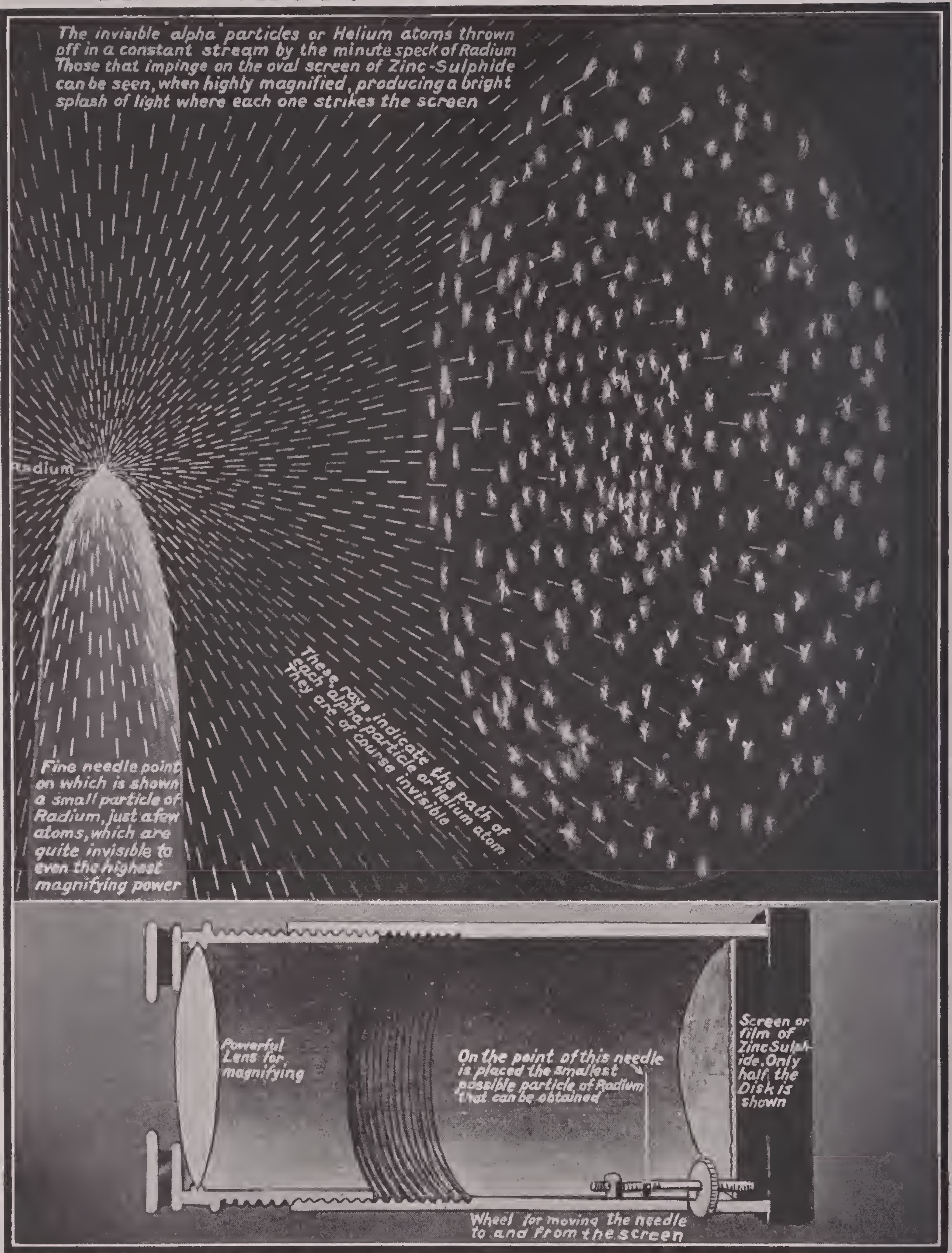
RACINE (*rȧ-sēn′*), **JEAN BAPTISTE** (1639–1699). Although he has been called the greatest dramatic poet of France, it may still be disputed whether Racine ranks higher or lower than Corneille, who first shaped French tragedy, or Molière, the great French comedian. Racine's genius at any rate was different from those others—beautiful, exquisite, poetic, and subtle.

Unlike those of Corneille, Racine's characters are well supplied with human frailties, whims, and errors. They are not great heroes, buffeting a rugged world; but they are rather twirled about in the swift current of their own passions. Thus Racine's plays are felt to be more lifelike than Corneille's; and the stories deal with what people think and feel and are, rather than with chance adventures through which they pass, no matter how nobly, or with great unnatural calamities which drop on them like bolts from the blue. Racine is also less concerned than Corneille with following set rules in writing. He observes a certain form, but he lets his own taste and the nature of his story decide for him what that form shall be. To some extent he freed French drama from the unnaturalness which comes from following rigid rules. His poetry is also more delicate, intimate, and emotional than Corneille's.

Probably much of Racine's feeling for simplicity, delicacy, charm, and sheer beauty for its own sake came from his early and wide study of Greek. He was born at La-Ferté-Milon, about 70 miles northwest of Paris. He lost his parents when he was a small lad, and his maternal grandfather then brought him up, sending him to Beauvais College, near Paris, and later to Port-Royal, a famous convent school of liberal opinion near Paris. He spent a solitary boyhood at Port-Royal, learning "large tracts of Homer, Sophocles, and Euripides," but this period was so happy that when he lay dying in Paris he asked to be buried at Port-Royal.

Racine's principal works are: 'Thébaide' (1664); 'Alexandre le grande' (1665); 'Andromaque' (1667); 'Les Plaideurs' (1668); 'Bérénice' (1670); 'Bajazet' (1672); 'Mithridate' (1673); 'Iphigénie' (1674); 'Phèdre' (1677).

THE "SHOTS" THAT RADIUM FIRES


The invisible alpha particles or Helium atoms thrown off in a constant stream by the minute speck of Radium Those that impinge on the oval screen of Zinc-Sulphide can be seen, when highly magnified, producing a bright splash of light where each one strikes the screen
Radium
These rays indicate the path of each alpha particle or Helium atom They are of course invisible
Fine needle point on which is shown a small particle of Radium, just a few atoms, which are quite invisible to even the highest magnifying power
Powerful Lens for magnifying
On the point of this needle is placed the smallest possible particle of Radium that can be obtained
Screen or film of Zinc Sulphide. Only half the Disk is shown
Wheel for moving the needle to and from the screen

From a speck of radium too small to be seen under the most powerful microscope a stream of helium atoms will pour forth for centuries before the energy of the radium has been dissipated. But if this stream falls on a zinc sulphide screen, each atom produces a little spot of light where it strikes and if the screen be viewed in the dark these spots can be seen winking upon the screen like the myriad splashes caused by hailstones hitting upon the sea. A simple arrangement of microscope and screen for this purpose is the "spinthariscope," shown in the lower part of the picture.

RADIUM—*The* RIDDLE *of* SCIENCE

The Most Precious Substance in the World, and How It was Discovered by the Brilliant Wife of a Famous French Scientist—Its Wonder-Working Powers that Upset the Theories of Chemistry

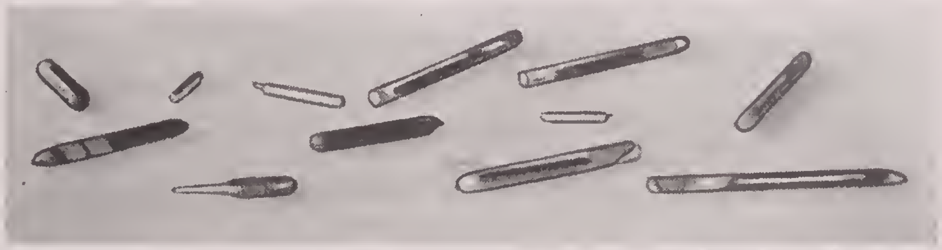
RADIUM. Alchemists of old spent their lives searching for the "philosopher's stone," which would change lead into gold. Modern science has found in radium a substance 67 thousand times more valuable than gold; and it is now believed that this substance itself changes back into lead. In many ways radium is the most remarkable material in the world. If it does change into lead, it performs wonders of which the old alchemists never dreamed.

MADAME CURIE
Discoverer of Radium

Radium was discovered in 1898 in Paris by Mme. Marie Sklodowska Curie, assisted by her husband, Pierre Curie, professor of physics at Sorbonne University. In 1896 Henri Becquerel, a noted French scientist, had observed that uranium, the heaviest of all chemical elements, gave forth rays, which, it is true, were invisible, but which could penetrate thin sheets of metal and leave their mark on a photographic plate. Madame Curie and her husband, pursuing these investigations, succeeded after immense labors in separating from uranium ores a new substance whose radioactivity, or power to emit penetrating rays, was two million times that of uranium. This amazing power gave radium its name.

The discovery of this new element created great excitement in the scientific world. For 200 years scientists had believed that the so-called elements of chemistry, such as iron, lead, carbon, etc., were unchangeable and could not be divided into simpler substances. From iron, they said, you can get nothing but iron; from lead, nothing but lead. The old theory of chemistry depended largely upon this supposition.

A HALF-MILLION DOLLARS' WORTH OF RADIUM



These tiny glass tubes have sealed up in them radium salts worth $500,000. Yet the whole lot could be held in a tablespoon.

But here was radium, a true element, which automatically expelled from itself tiny particles of matter which proved to be atoms of another well-known element, helium. What had been declared impossible was actually taking place; one element seemed to be "creating" another element. Furthermore, prolonged tests seemed to indicate that, after a number of other startling transformations, radium eventually turned into common lead.

But this was not all. The laws of physics were apparently in just as great peril. In 1847 Baron von Helmholtz had announced the principle of the conservation of energy, on which rests the whole structure of modern physical science (*see* Energy). This law says that no energy is ever created or destroyed. Yet it was found that radium constantly threw off great quantities of energy in the shape of heat, light, and electricity, *without seeming to lose any of its weight and power.* Wasn't this creating new energy?

In the face of these facts, old ideas had to be readjusted. Careful experiments soon showed that radium does actually lose some of its weight, but so slowly that it would take 1,760 years for a given quantity of this substance to lose half of its activity. The decay is so slow, compared to the vast amount of energy produced, that it still upsets all previous conceptions of physical energy.

"Suppose," says Sir William Ramsey, a famous Scotch chemist, "that the energy in a ton of radium could be utilized in 30 years, instead of being evolved at its invariable slow rate of 1,760 years for half-disintegration; it would suffice to propel a ship of 15,000 tons, with engines of 15,000 horse-power, at the rate of 15 knots, for 30 years—practically the life of the ship. To do this actually requires a million and a half tons of coal."

The evolution of radium into helium, as well as the puzzling energy of radium itself, has been partly explained by the electron theory of matter (*see* Atoms and Electrons). Thus the old laws of science do not have to be abandoned, but are merely expanded and interpreted in a new way. This new view leads to the belief that all physical matter, and all the elements of chemistry, are at bottom simply different manifestations of the same fundamental energy-substance.

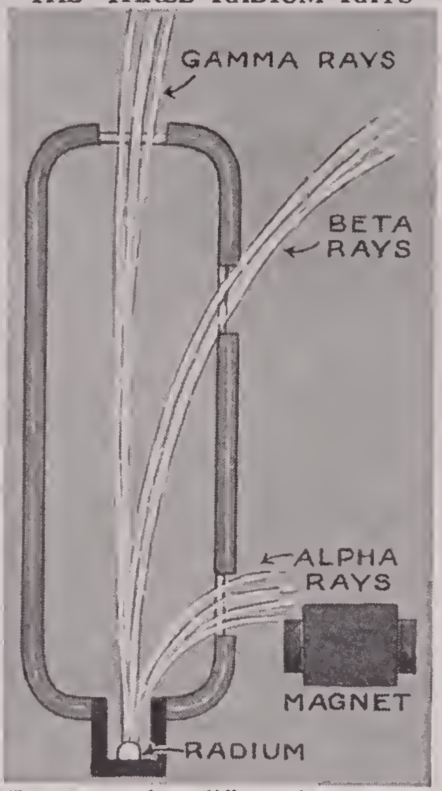
Radium has spectacular qualities which make it deeply interesting. It is the rarest of all commercial products, because of the immense difficulties of producing it. It takes 3,700,000 pounds of uranium ores to produce one pound of radium, and a pound of radium is worth $18,000,000. Needless to say, radium is not sold by the pound. In 1910 Mme. Curie succeeded in isolating pure metallic radium.

It is white as silver, and in a vacuum retains its brilliant luster, but if exposed to the air it tarnishes rapidly. A heat of 1,292 degrees Fahrenheit is necessary to melt pure radium.

Radium emits three kinds of rays, called after the first three letters of the Greek alphabet, *alpha* rays, *beta* rays, and *gamma* rays. The alpha rays are the ones which yield helium. Their escape from the radium atom gives rise to a substance which has been called radium emanation. They also carry two positive unit charges of electricity. They can be stopped by a sheet of paper. The beta rays have much greater penetration and carry a negative unit charge of electricity. The gamma rays are the most powerful of all, capable of penetrating 2¾ inches of solid lead, or about 60 inches of water. Their effects are similar to those of X-rays. (*See* X-rays.)

Radium has the power of exciting phosphorescence in many other substances. The most brilliant effect is produced by placing a screen of zinc sulphide near a glass tube containing radium. In a dark room the sulphide will be seen throwing off innumerable bright sparks, as if bombarded by showers of shooting stars.

THE THREE RADIUM RAYS



Here we see how differently a magnet affects the three different radium rays. By confining the radium in a lead casing with proper openings like this one, the rays can be studied separately.

The effect of radium rays on diamonds is perhaps the most puzzling of all. Sir William Crookes, an eminent British scientist, reported in 1914 that a large white diamond which nine years before he had exposed to radium rays for 16 months still continued to show without apparent decrease the same powers as radium itself. It had turned a beautiful green, and no acids or other chemical agents would remove this color.

IN QUEST OF THE WORLD'S MOST PRECIOUS MINERAL

This miner in Paradox Valley is pointing to a vein of carnotite, an ore which yields radium. Paradox Valley, extending from western Colorado into eastern Utah, is the richest radium-bearing area in the world.

Radium, even in the most minute quantities, has the peculiar power of causing all substances within the scope of its rays to become electrical conductors, no matter what excellent insulators they may be ordinarily. This power is used to determine the presence of radium in other materials.

The continuous flow of heat produced by radium is sufficient to keep the substance about three degrees above the temperature of the surrounding atmosphere. It is perhaps fortunate for the world that radium exists in such small quantities in nature, for its effects are exceedingly dangerous. If the smallest visible amount is carried in a pocket near the skin, it will produce a very bad burn, difficult to cure.

Under proper conditions, however, this property of radium is used to treat tumors and cancerous growths. When radium was first discovered, it was hailed as a cure for cancer; but prolonged experiments have shown that, for the present at least, its value in this direction is limited. Radium emanations, which can be dissolved in water, have been administered internally by some physicians, but the results have not been encouraging. In any medicinal use of radium, the danger of burns must always be carefully guarded against.

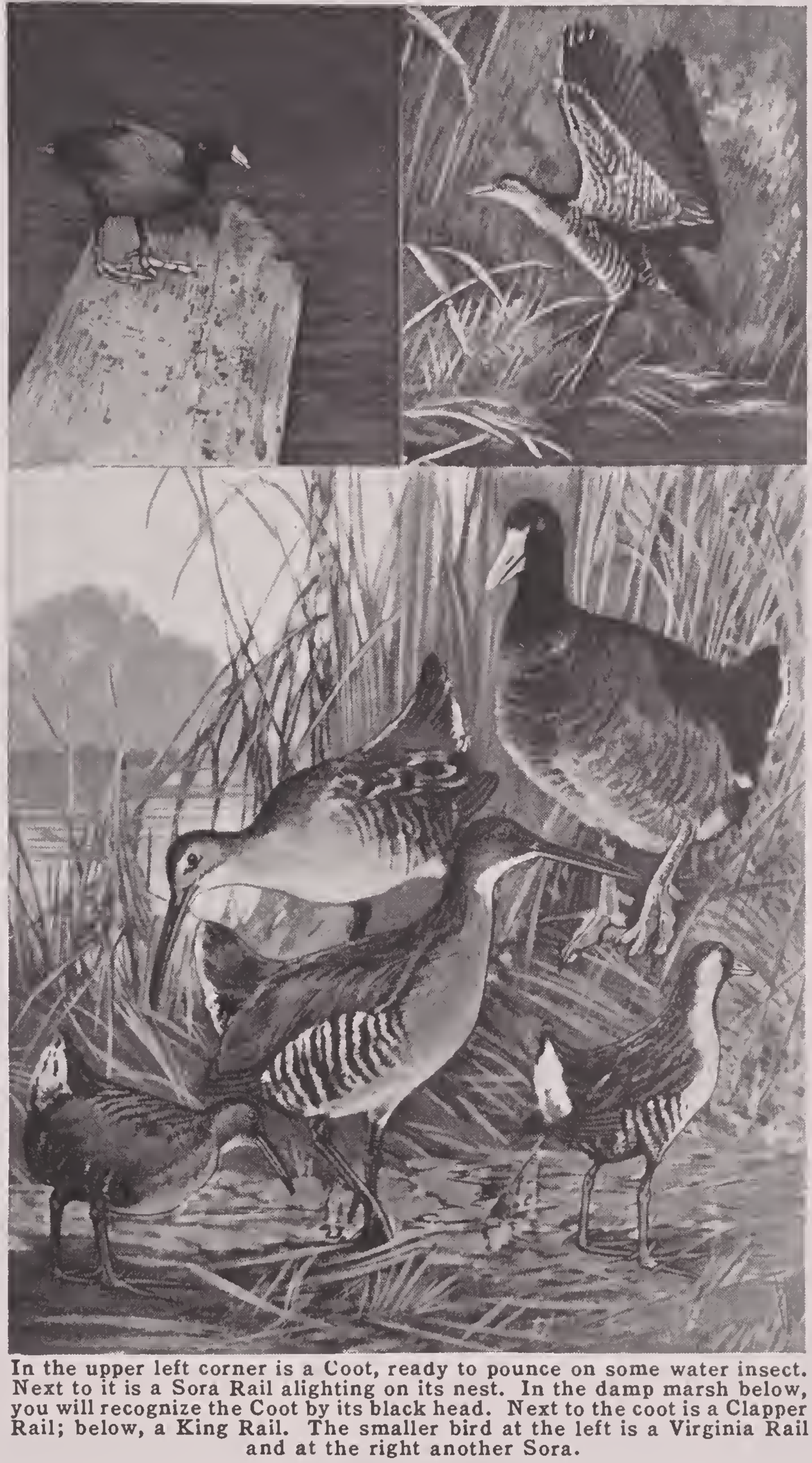
Radium was formerly obtained exclusively from the deposits of pitchblende or uranium ore in Austria. These ores contain about 80 per cent of uranium salts, and where uranium is found radium is always present in the proportion of 3.4 parts for 10,000,000 parts of the heavier metal. In recent years the United States Bureau of Mines has developed on a large scale the carnotite fields of Colorado and Utah, which contain a large proportion of uranium compounds. This bureau succeeded in the first two years of its work in doubling the total quantity of radium in the world, and in reducing the cost of production by one-half. Pure radium is not produced for commercial or scientific use. It is usually used in the form of radium chloride or radium bromide, and the radium prices quoted always refer to one or the other of these salts.

Many other chemicals possess to a much milder degree the radioactive powers of radium. Thorium and actinium are the two principal ones. Some investigators have observed what they believed to be faint traces of such powers in common lead. The list of such substances is constantly growing. As Sir J. J. Thomson, another great English scientist, said in 1908: "Researches have led to the discovery of so many new radio-active substances that any attempt at christening them seems to have been abandoned, and they are denoted, like policemen, by the letters of the alphabet."

Radio-active substances, chiefly emanations, are distributed throughout the earth and air. If a suspended wire be given a negative charge of 1,000 volts or more, it will collect enough radio-active material to produce an effect on a photographic plate. In fact, radio-active substances are so widely distributed that their effects in laboratory experiments cannot be avoided, even by elaborate precautions.

RAIL AND COOT. As marsh-dwelling birds, the rails and coots belong to the same order as the long-legged large-bodied cranes. They have the same general structure as well, and the same characteristic habit of flying with extended neck. There are about 180 species of the family, distributed all over the world. They nest among the rushes of the marsh and as a rule lay from 8 to 12 eggs. They feed on insects and small forms of aquatic life, with seeds and water plants.

THEY LOVE DAMP HOMES



In the upper left corner is a Coot, ready to pounce on some water insect. Next to it is a Sora Rail alighting on its nest. In the damp marsh below, you will recognize the Coot by its black head. Next to the coot is a Clapper Rail; below, a King Rail. The smaller bird at the left is a Virginia Rail and at the right another Sora.

The rails have small compressed bodies. They run rather than fly, and when startled they disappear between the dense rushes with a sliding movement that it is impossible to follow. They have secretive habits, keeping well under cover except at night or in the twilight, when they may be seen walking along the margins of marshy streams. The plumage is dull greenish-brown mottled with buff, and blends well with the green-brown of the marsh.

The rail can suit his voice to the frog chorus of his home, or he can make it wild and sweet as the notes of the whippoorwill or vireo. In the fall when fattened on wild rice, rails are sought for the table. When autumn rains flood the marshes, boats are poled among the reeds and hundreds of thousands are shot. As the ponds freeze, the birds migrate southward. Their wings, which during the summer months have been but little used, now carry them far and high. They have been known to alight on vessels hundreds of miles at sea, and they have been taken on mountains as high as 12,500 feet.

The sora rail, which is widely distributed in the United States, looks like a tiny bantam hen. Its ability to squeeze between the thickly growing reeds has given rise to the phrase "as thin as a rail."

The coot, like the rail, is often called a "mudhen," and again, it is often mistaken for a duck; it is also given the highly descriptive name of "hell-diver." Coots have queer lobed toes which assist them in swimming. They are about 14 inches long, with slaty-black plumage; the bill is pointed and ivory white. Their odd way of skittering or running over the surface of the water, supported on fluttering wings, is only one of their many interesting habits. As the ice appears the coot disappears. The flesh of the coot is not palatable, and he is difficult to shoot because of his quickness in diving and his ability to swim long distances under water. Scientific name of sora rail, *Porzana carolina;* of coot, *Fulica americana.*

The STEEL ROADS *that* COMMERCE TRAVELS

Five Locomotives Moving a Heavy Passenger Train through the Wasatch Mountains in Utah

A LITTLE over a hundred years ago, the stagecoach, wagon, canal-boat, and sailing ship were the only means of transportation. Cities were dependent upon the surrounding countryside for food, and when they reached a certain size they had to stop growing, because food could not be found for more. Today every little village draws upon the entire world for its subsistence. The people of an Iowan hamlet eat wheat grown in Dakota, fruit from California, Louisiana rice, and Baltimore oysters; they wear shoes made in New England, clothing from Chicago, and use lumber cut in Washington. For most of this change we can thank the railroad, the great agency that has done more than any other single factor to make modern civilization possible.

RAILROADS. Today "iron horses" speed along steel tracks laid on every continent of the globe, drawing trains which carry people of every race and products of every land. They cross mountains, dash through forests, roar through tunnels, and pass safely over bridges that are monuments of engineering skill. Who invented these railroads? How are they operated? And what is their importance, that we spend so much money and energy in their building?

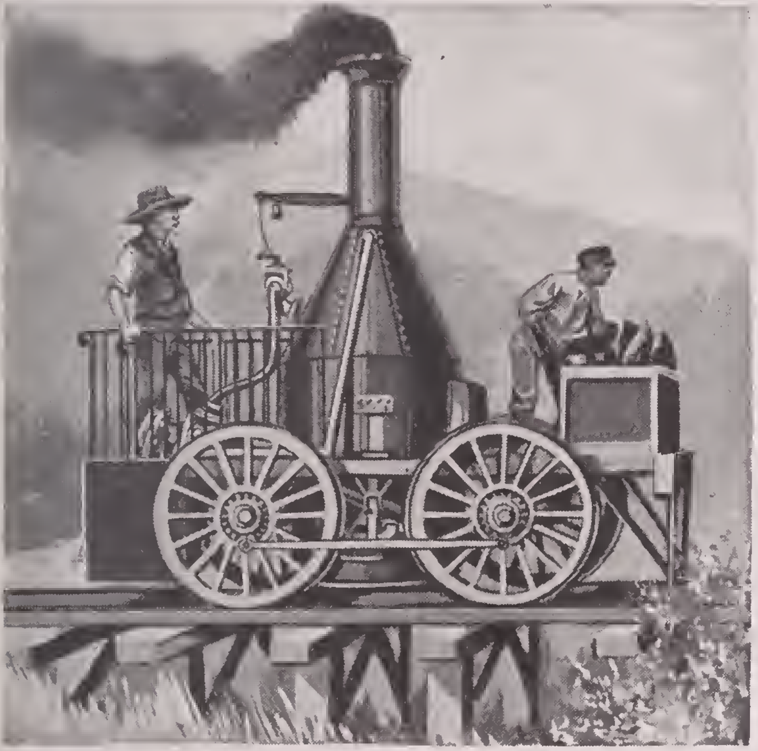
It is only a little over a century since the first of the "iron horses," or locomotives, came into existence. But long before that, a queer road of wooden rails laid end to end was built for horse-drawn wagons that hauled coal from mines in England. The tracks were raised above the level of the mud, fastened to the ground, and provided with flanges or ridges on the outer edges to prevent the wheels from slipping off the track, or "tramway." These were the first "rail" roads. Later the wooden rails were covered with strips of metal, the flanges were put on the wheels instead of on the track, and several loaded wagons were sometimes hauled by a single horse, linked together in a miniature train.

With the invention of the modern steam engine by James Watt, men began to study how to apply this new power to hauling on these tracks. A stationary engine was at first used, which stood at the end of the road and wound up a cable drawing the wagons along. The credit for inventing the first moving steam engine is given to Richard Trevethick, who in 1802 took out a patent for a steam "locomotive," but it was too imperfect for practical use. For a time it was believed that cog-wheels, fitting into cogs in the rails, would be necessary for drawing heavy loads, but before 1812 it had been proved that a locomotive with smooth wheels on smooth rails could draw heavy loads even up a moderate incline.

At this stage of progress, William Hedley invented (1813) a locomotive for use in the coal mines about Newcastle in England, which on account of its loud noise was called "Puffing Billy." George Stephenson, in 1814, brought out a locomotive which was used on a nine-mile tramway between a mine and its seaport, but it could not move a train much faster than a horse could walk. Then (in 1825) came Stephenson's engine, for the Stockton and Darlington Railway, in which the exhaust steam was sent up the chimney, causing a powerful draught in the firebox. This caused more rapid generation of steam and gave more power to the engine. Soon afterwards (1829) his engine, the "Rocket," made use of a multitubular boiler, and the essentials of the successful locomotive were complete (*see* Locomotive; Stephenson, George). The engines increased in size and improved in detail, but the 400-ton monsters in use today are the big brothers of the old "Puffing Billies" and "Rockets."

Meanwhile the use of the railway itself was extending. The first horse-drawn railway in the United States was built in 1826, for hauling granite near Quincy, Mass.; and over this was hauled stone for the Bunker Hill monument. Railways had ceased to be private conveyances and become public carriers, for the Stockton and Darlington Railway, in England, was built for general traffic, and the first coaches for passengers were run over this line. The public line from Liverpool to Manchester, for which Stephenson's "Rocket" was built, was formally opened in 1830. The Baltimore and Ohio was the first steam railroad for general use in the United States. This line was chartered in 1827 for horse-drawn cars, but it was not until 1830 that a locomotive, the American built "Best Friend," was put into use. Peter Cooper had begun work in 1829 on the "Tom Thumb," and this locomotive was also put into service on the Baltimore and Ohio in 1831.

THE FIRST AMERICAN LOCOMOTIVE

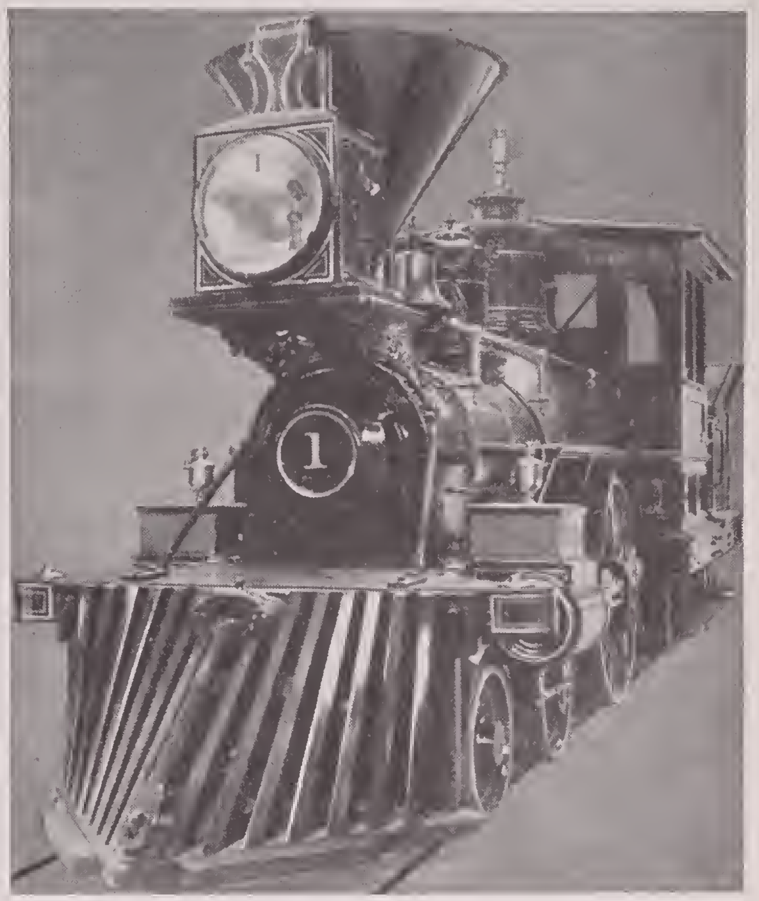


The "Best Friend," built in New York City in 1830, was the first American built and designed locomotive. After six months of use, the boiler exploded.

Less than a hundred years later, railroads were found on every continent on the globe, with more than 350,000 miles of road in the Americas, 225,000 miles in Europe, 65,000 in Asia, and 25,000 each in Africa and Australia. In the United States alone there are now more than 270,000 miles of road, and more than 1,700,000 persons are employed in the freight and passenger service. These roads carry in one year more than one and a quarter billion tons of freight, and the trains travel a distance nearly equal to seven round trips between the earth and the sun. If all this distance were covered by one train, it would have to travel at the rate of 60 miles an hour for 2,400 years.

In the United States six transcontinental lines have been built. The first was the Union Pacific, completed in 1869; from Omaha on the Missouri River to San Francisco—a distance of more than 1,800 miles—its tracks were laid through a region practically uninhabited. The Southern Pacific followed in 1881, building from San Francisco to New Orleans, 2,489 miles, making it the longest transcontinental road in the United States. The other roads are the Northern Pacific, from St. Paul to Portland, Ore.; Atchison, Topeka, and Santa Fe, from Kansas City to San Diego; the Great Northern, from St. Paul to Seattle; and the Chicago, Milwaukee, and St. Paul, from Chicago, via Minneapolis and St. Paul to Seattle. In Canada, the Canadian Pacific, a transcontinental line 2,906 miles in length, from Montreal to Vancouver, was completed in 1885. The longest transcontinental system in the world is the Siberian Railway constructed by the Russian government from Petrograd to Vladivostok, a distance of 5,435 miles, the main line of which was finished in 1904. Even greater than this will be the "Cape-to-Cairo" road through British Africa, which will cross the Dark Continent from the Cape of Good Hope to the Mediterranean.

A WOOD BURNER OF THE 60'S



In the earlier days of railroading, locomotives used wood as fuel. This "wood-burner" is typical of those built about 1860.

As a result of this development, human life has been transformed. In the United States, before the coming of railroads, communication between the different sections was slow and beset with many dangers. As a result sections were developing separate interests, such as were revealed in the Civil War in the widely separated attitudes of the North and the South; the Pacific coast, also, had little in common with the eastern states. But the iron bands of the railroad have reached out east and west, north and south, binding the states into a nation "one and indivisible," and now the Pacific and Atlantic are as close together, measured by the time required for communication and travel, as were Boston and New York in the old stagecoach days. So, too, in Canada, which could never have been successfully united into one Dominion without the railroad to bind together the eastern, central, and western provinces.

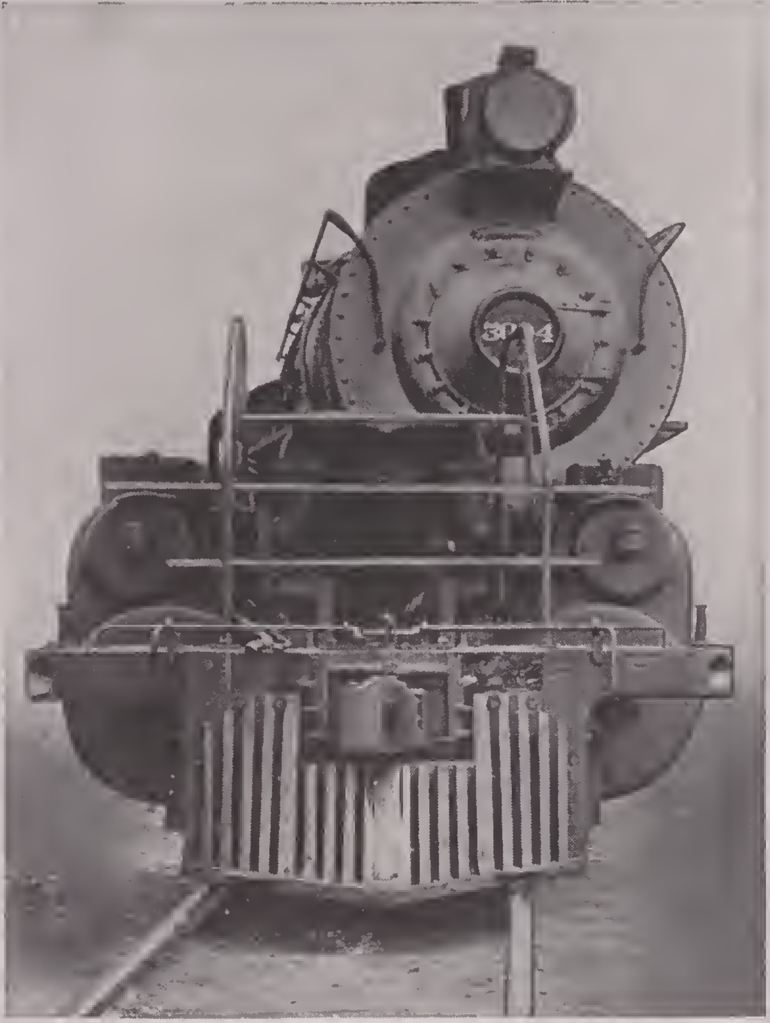
The story of railroad building is as fascinating a subject as any in the long record of human progress. In building a railroad, the first work is the preliminary survey, or "reconnaissance." In the American Far West, the problem always was to find the best route to use over the Rockies, and the reconnaissance parties had many thrilling adventures with hostile Indians and the perils of mountain, forest, and desert. At the present time most of the country has been mapped by the government, so that the preliminary work of the reconnaissance surveys is often unnecessary.

Usually several routes are studied, and rough maps and profiles showing the features of each one are prepared. Experts then choose the best route; the choice they make has much to do with the success or failure of the new road.

One route may be fairly level, requiring only a few "cuts" through hills and "fills" over valleys. But it may require a tremendous tunnel to get under an intervening mountain, or several expensive bridges, which will make it more costly in the end than one with moderate "cuts" and "fills" all the way. Or one may be inexpensive to build, but run through unsettled country. Hence it may be wiser to build the more expensive line, for the sake of the greater local business it can get.

This route selected is then surveyed carefully and building commences. Sometimes parties begin at each end and work toward the middle, in order that the completed track may be used to supply the workmen. Nowadays parties can be stationed at various points particularly where there are hard jobs, such as tunneling, and are supplied from other railroads already built near by. This method gets the road finished and earning money much more quickly.

THE LARGEST LOCOMOTIVES HAVE JOINTS



So large are many modern locomotives used for hauling heavy freight trains over mountains, that they could not round some of the sharp curves if they were not "jointed." The joint consists of a bearing on the front running gear, which permits the wheels to slide from side to side under the boiler.

The first work is the preparation of the road-bed. Following the stakes and plans prepared by the surveyors, the working parties clear away trees, make "cuts" and "fills," and otherwise prepare the way. Other parties set up bridges and dig tunnels.

As fast as the road-bed is ready, the track is laid, either by hand or by ingenious machines which feed the ties out on a belt, and put the rails in position. Working on level ground, track-layers can complete several miles in a day. Then the track must be ballasted, preferably with gravel, cinders, or stone, and then "seasoned," or shaken down.

In America the usual practice is to build a single-track line with as few tunnels, bridges, and expensive cuts and fills as possible, and start earning money. Then as the railroad prospers, "short cuts," called "air-lines," are made to eliminate sections of winding track which were built to avoid tunneling or grading. Then the track is doubled, first at portions where most trains pass, and finally over the entire route, and thus the railroad "grows up" into a first class line. This method is largely responsible for the great development of railroads in America, because it enabled companies to build roads in comparative wildernesses and make them pay. The railroad built up the community, and the community, by the business it afforded, in turn enabled the railroad to improve itself. Under the European practice of building an expensive line at the outset, and building only in settled districts, vast portions of the American West would still be wilderness today.

The Rails and the Rolling Stock

The rails are as important as the locomotive in the advance of railway transportation. A great improvement was made about 1820 by the substitution of tough wrought-iron rails for the perishable wooden or brittle cast-iron rails hitherto used. Steel rails are now used exclusively, and the rapid and enormous expansion of railways after 1865 is largely due to the new Bessemer process (*see* Iron and Steel), which makes it possible to produce great quantities of steel rails easily and cheaply. The rail used universally in America for steam railways is known as the flanged T-section, and was invented in 1830. It is made usually in 30-foot (sometimes 60-foot) lengths, and of weights varying from 25 to 100 pounds per yard.

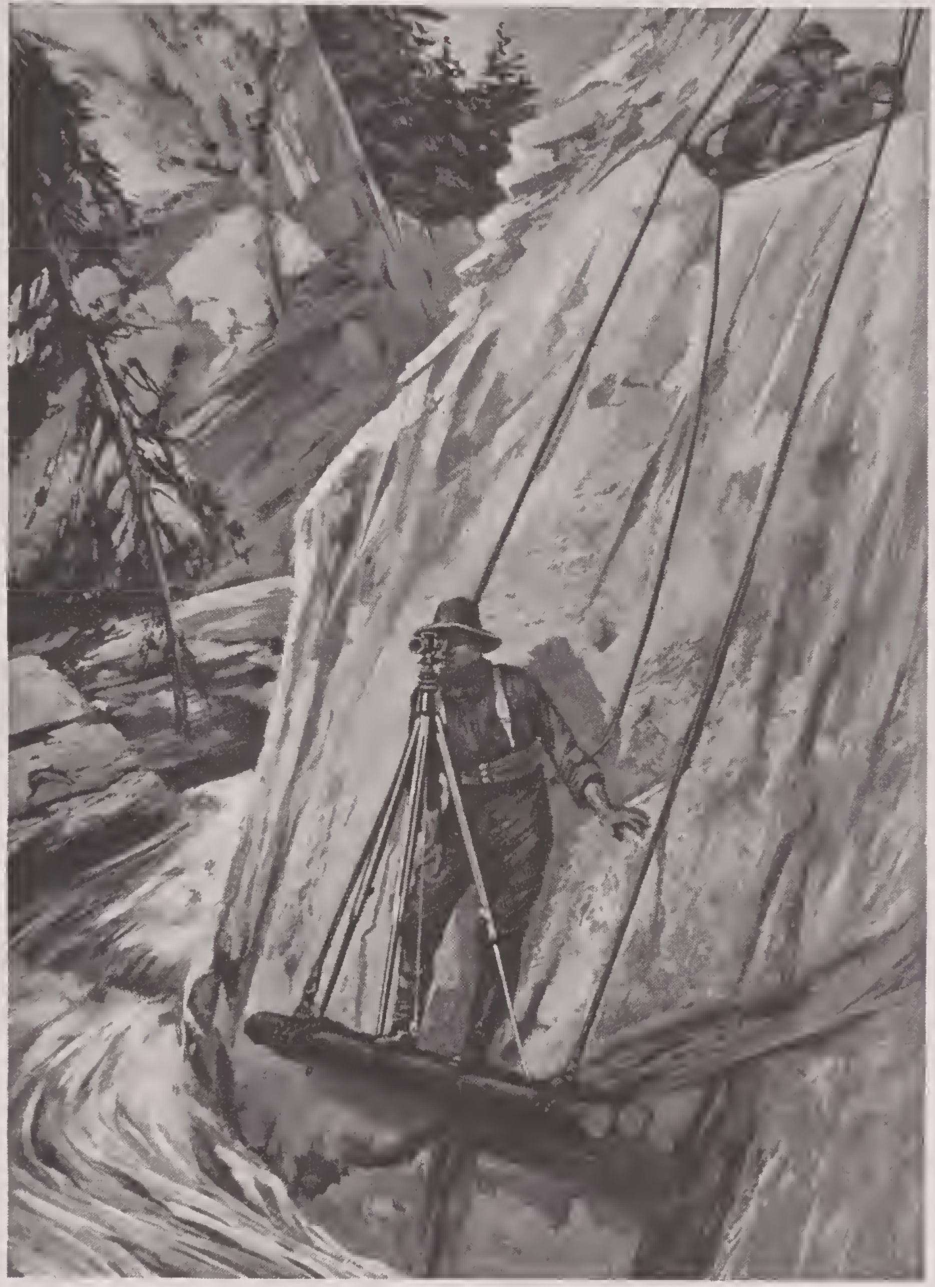
The "gauge" of the track is the distance between the rails of the two sides. "Standard gauge" for American, Canadian, and most European railways is 4 feet 8½ inches wide; this was the distance over all of the old wagon wheels. "Narrow gauge" (which may be as narrow as 2 feet 8½ inches) is used in America chiefly in mountainous regions. "Broad gauge" of varying widths beyond the standard has been used in different European countries.

All track must be kept "full spiked" and in perfect gauge to insure safety. Track is maintained by section gangs, a gang of four to seven men with a foreman having charge of a section of road—from five to eight miles of single track, and a proportionately shorter distance of double, three-track, or four-track road.

There has been a similar improvement in the "rolling stock," by which is meant the coaches and cars for the transportation of persons and freight. The earliest passenger cars were built like four-wheel stagecoaches, and early freight cars like four-wheel wagons. About 1835 long-bodied cars mounted on four-wheel or six-wheel swiveling trucks began to be built, and this type is universally used in the United States and Canada today. It is economical to operate, because the weight of the car in proportion to the load decreases as the load carried by a single car increases; and it has facilitated the development of specialized forms, like the dining-car, which make railway travel comfortable or luxurious. The modern long-distance passenger trains may have baggage cars, express cars, mail cars, passenger day coaches, dining cars, sleeping cars or Pullmans, and perhaps an observation car.

An American passenger car is entered at the end and is traversed by a center aisle, while European cars are divided into compartments and usually entered by a number of doors in the side. American day cars or coaches are from 65 to 80 feet long, and seat from 60 to 90 passengers each. Chair cars will not seat quite so many in the same space. The American standard sleeping car is about 70 feet long, and has 16 sections, with a private compartment or stateroom at each end of the car. The Canadian Pacific Railway owns and operates sleeping car and other services, including restaurant, and some roads in the United States own and operate their sleeping and dining car services; but most American roads carry sleeping and dining cars owned and operated by the Pullman Company. Where the sleeping car traffic is light, the roads pay the Pullman Company a rental (the receipts from Pullman passengers belonging in any case to the Pullman Company), but where the traffic is heavy the Pullman Company pays the railway for carrying its cars. Passenger cars are heated by exhaust steam from the boilers, and lighted either by electricity which is generated and stored as the train is in motion, or by gas carried in cylinders.

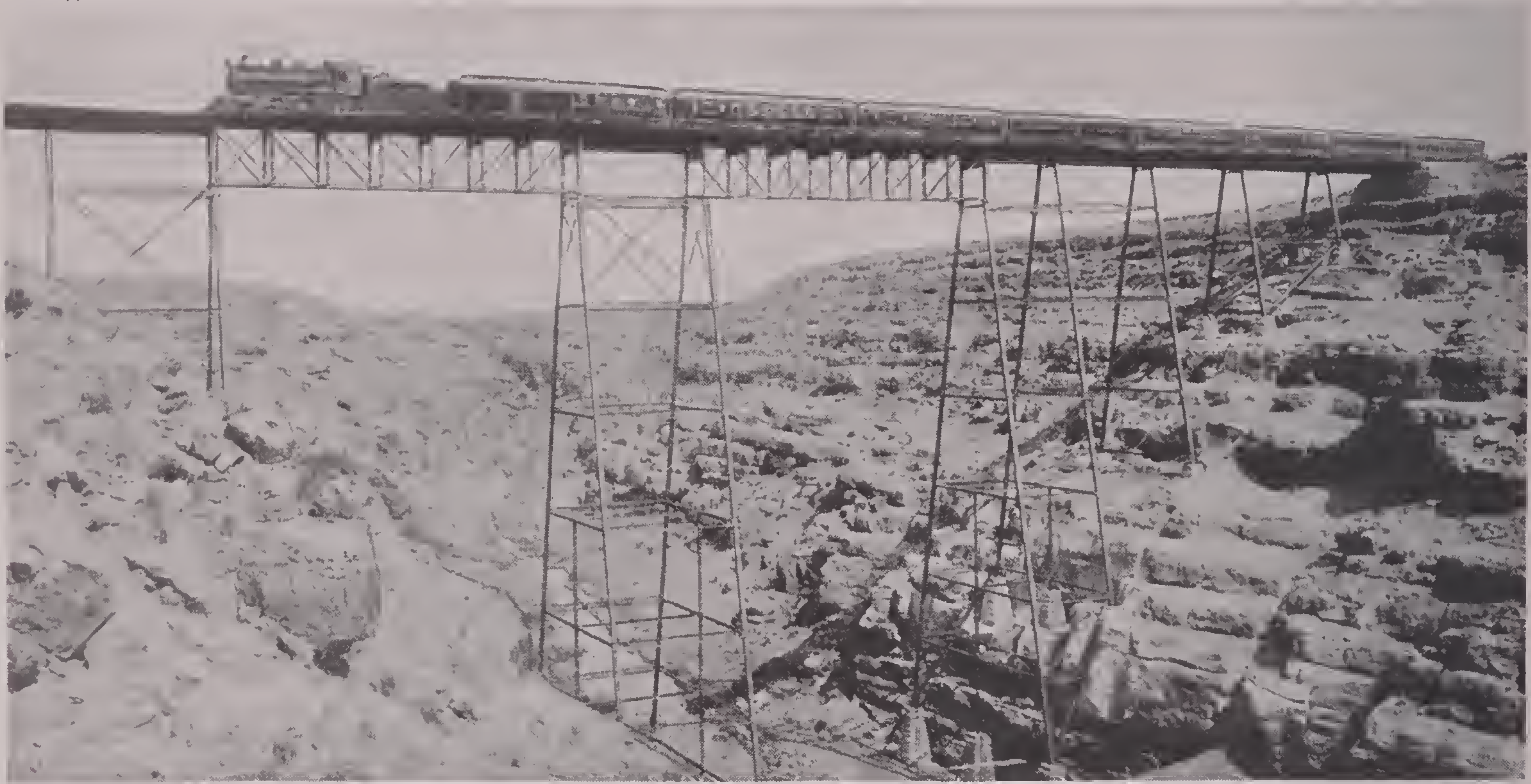
BLAZING A TRAIL FOR CIVILIZATION



The railroad surveyor, especially in mountainous countries, has a thrilling career. To him belongs the glory of the pioneer and explorer. In the early history of American railroads, as still today in Africa and other remote regions, he not only forced his way over stream and chasm but often had to fight savages and wild beasts.

The ordinary American freight car is from 30 to 42 feet long, and few are of less than 30 tons' capacity; but European freight cars are much smaller. Cars have been constructed for different classes of freight, and an American freight train is often made up of flat cars, box cars, coal cars, gondola cars, hopper cars, tank cars, and (for perishable freight) refrigerator or heated cars. The caboose is the car in which the freight train crew rides. Steel cars are now taking the place of wooden cars for both passengers and freight because, although heavier, they are more durable and offer better protection against fire and wreckage.

WHERE TRAINS TRAVEL ACROSS A SPIDER-WEB OF STEEL



When the surveyors and engineers who built the Atchison, Topeka & Santa Fe reached Canon Diablo (the Devil's Canyon) in Arizona, they were confronted by a terrible gash in the surface of the plateau. The canyon is 550 feet wide and 225 feet deep, and so many miles long that there was no chance of going around it. The only way to outwit the "devil" was to jump over his lair. So the engineers built this spider-like bridge of steel, over which great trains travel day after day.

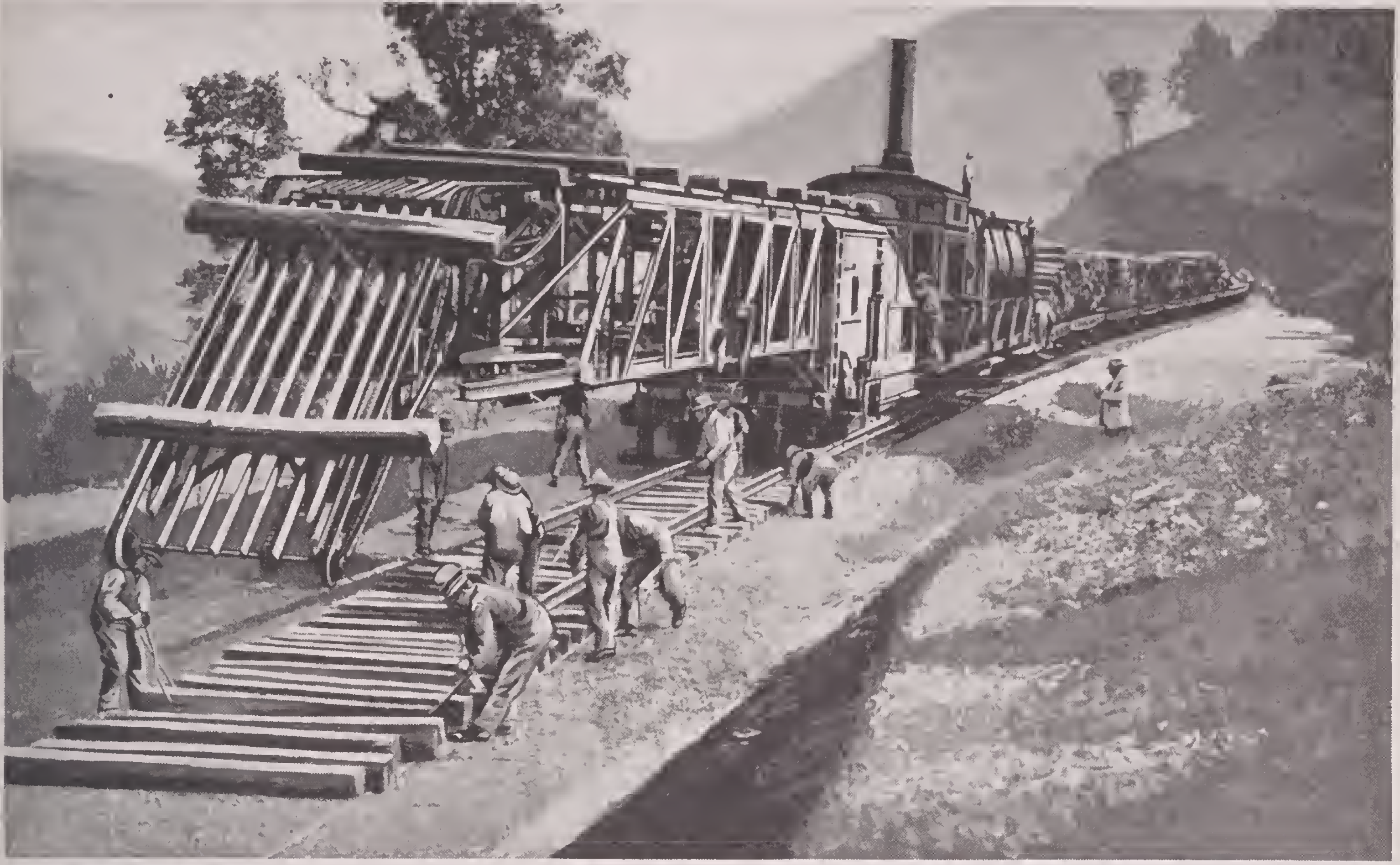
The old links and coupling pins, operated by hand to join the cars together in a train, caused the death or injury of many trainmen. The use of automatic couplers, which grip as soon as they are in contact, has practically eliminated this danger. The compressed air brake has minimized the jerking and bumping of the train in starting and stopping, and has also greatly lessened the danger of accident because of the quickness with which a train can be stopped. (*See* Brakes.)

A modern railroad owns, besides its roadway and rolling stock, numerous passenger stations, freight houses, water and fuel stations, repair and construction shops, engine houses, elevators for storing and loading grain, and often docks, tugs, ferries, and steamboats, with forests for the supply of ties, reservoirs for water, and even in some cases coal mines for fuel supply.

The terminal passenger stations in large cities are often huge and magnificent buildings (sometimes union stations used by several roads), containing almost every imaginable convenience for the traveling public. Such are the South Station in Boston, the Union Station in Washington, and the two largest railroad stations in the United States, the Grand Central and the Pennsylvania in New York City. The Pennsylvania is the largest railroad terminal under one roof in the world; it covers seven and a half acres. Its main waiting room, the largest of its kind in existence, has a floor covering 33,000 square feet and is 150 feet high. Both the Grand Central and the Pennsylvania have the usual railroad, express, and telegraph offices, telephone booths, restaurants, restrooms, news-stands, etc., and in addition hospitals for travelers suddenly taken ill, shops where they may supply almost any need, and rooms set apart for funeral parties obliged to wait for trains. The Grand Central Station even has private dressing rooms where travelers may prepare for evening parties or the theater, with valet or maid service, if they so desire. About 600 trains a day arrive at and leave this station, and 450 at the Pennsylvania. The South Station in Boston has about 725 trains in and out daily, and the great station in Melbourne, Australia, is said to have an average of 1,600 daily.

Coal and water must be provided at suitable intervals along the road. The fuel stations ordinarily are provided with coal in elevated bins or pockets, from which it can be dumped into the locomotive tender through a chute or hinged spout. To avoid the necessity of stopping a fast passenger express train to take water, some roads have built "track tanks" from which a locomotive can scoop up water

A CONSTRUCTION TRAIN LAYING ITS OWN TRACK AS IT GOES



The first step in laying a track by machine is to bolt together enough rails in two continuous strings to reach from the flat-car at the rear on which they are piled to the pioneer car or engine. This double string is pulled steadily forward by compression rollers in the engine, passing through a space left beneath the ties on the other flat-cars. As the rails pass from the flat-car nearest the engine, ties are laid upon them at regular intervals. When they reach that bridge-like structure in front of the engine, the ties are picked up by endless chains and passed over the top, finally sliding off to the roadbed, where men place them in position. Meanwhile the rails slide forward, as you see them in the lower part of the bridge-like extension. As fast as they come out they are unbolted, ready to be lowered upon the ties when a proper position has been reached. The final spiking is done after the entire train has passed on.

while going at a rate of 30 to 40 miles an hour. A track tank is a pan 4 to 7 inches deep, 20 to 24 inches wide, and 1,200 to 1,500 feet long, and supplied with steam and circulating pipes to prevent freezing. The locomotive tender is provided with a hinged pipe which terminates in a scoop at one end and an elbow discharging into the tender tank at the other. As the train flies over the track tank, the scoop end of the pipe is lowered into the pan and the speed of the train forces the water up through the pipe into the tender tank. Oil is used for fuel in the Southwest.

Repair shops are also necessary. A road of fewer than 800 miles will ordinarily have one general repair shop, with shops for light and running repairs at division terminals (a division is a section of the road, and may be as short as 150 miles or as long as 650 miles), if the road is a busy one. Many railroads have construction shops as well, where they build at least part of their rolling stock.

The engine house, to which an engine goes to be inspected and cleaned and given light repairs if not at once sent out again at the end of a run, is usually, on American roads, of the "roundhouse" type. The roundhouse wall is built on the segment of a circle. The approach track from the yards leads up to a turntable in the opening of the segment. Radiating from the turntable and ending against the circular wall are a number of tracks (called "stalls") upon any one of which a locomotive can be shunted by means of the turntable.

Ferry services are of much importance on some roads. Where bridges or tunnels are impracticable, car-transfer boats may be used to convey cars across streams or lakes. The Southern Pacific Railway operates on San Francisco Bay a car ferryboat with four tracks and a capacity of two locomotives and 36 freight cars or 24 passenger cars. A car ferryboat operating over a distance of 56 miles on Lake Ontario (from Rochester, N. Y., to Coburg, Ontario) can transport thirty 50-ton coal cars at once. A still longer car ferry route (63 miles) is that across Lake Michigan from Frankfort, Mich., to Kewaunee, Wis. The boats, each of which carries 24 cars, are icebreakers capable of breaking their way through a foot or more of ice. The wharves and waters bordering on New York City, Hoboken, and Jersey City serve as hundreds of acres of switching yards, freight trains being broken up into short sections and run on flatboats towed by tugs, by which they are transferred from one railroad to another or to loading piers.

Besides all the equipment necessary for the operation of a steam railway, several of the great lines of the United States have also installed elaborate electrical equipment on part of their systems, where it

HAULING FREIGHT WITH ELECTRIC POWER

Here an electric locomotive is hauling sixty-five loaded cars up a heavy grade on the Norfolk & Western in winter. Because of the difficulty of maintaining steam in winter, this feat is one which a steam locomotive would find exceedingly difficult to perform. Electricity is admittedly the best motive power for such work.

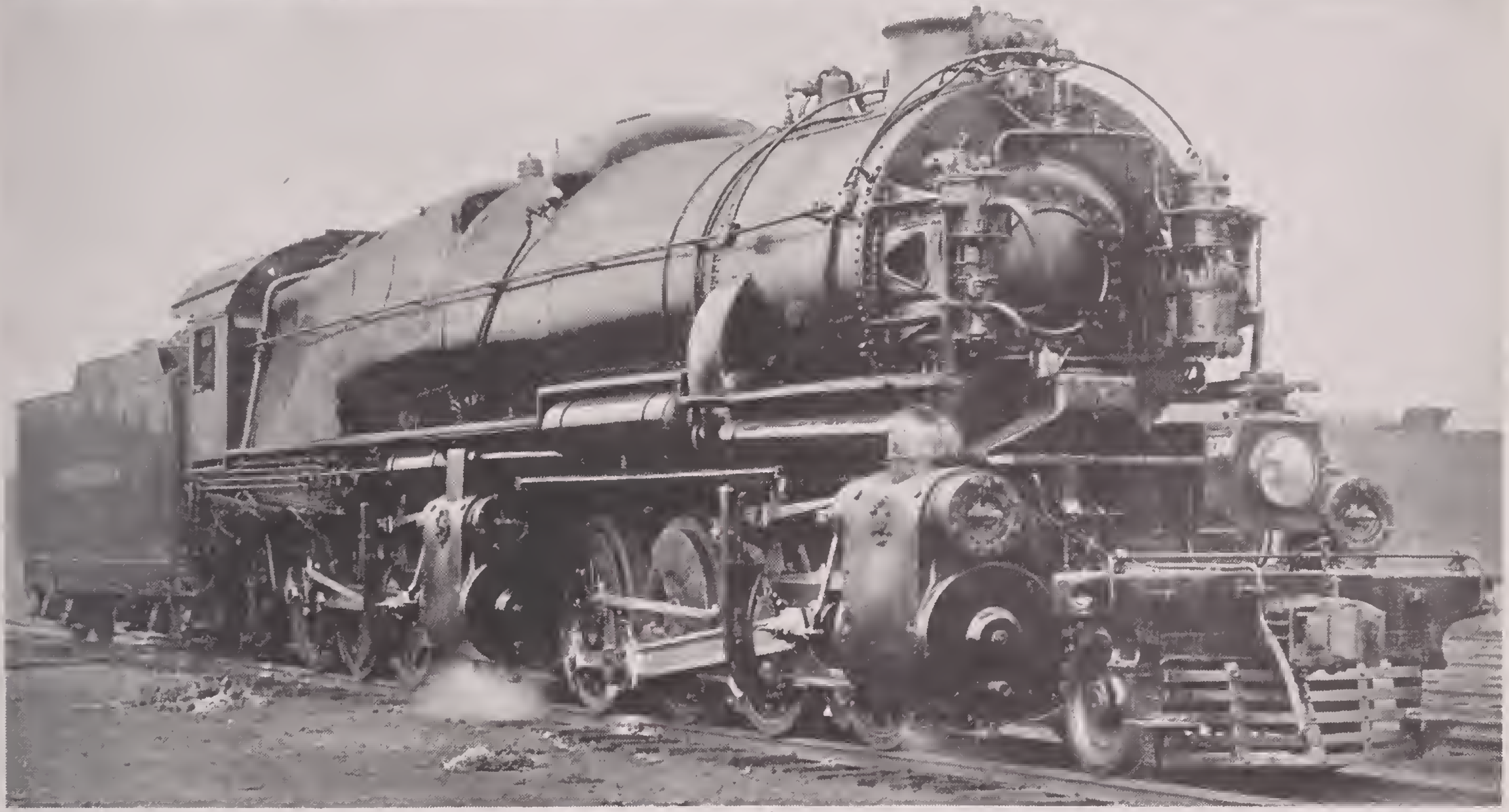
had been found desirable to do away with the steam locomotive. This has been done chiefly in terminal and suburban service in and about New York and in the operation of trains through tunnels, with the aim of eliminating smoke and noise and adding to the comfort of travel. In the electrification of the Chicago, Milwaukee & St. Paul route across the continental divide in Montana and Idaho, the purpose was primarily efficiency in operation, because the giant electric locomotives, 113 feet long, are each capable of doing the work of four steam locomotives. They can keep up almost double the speed of steam locomotives on heavy grades, and their efficiency is greatest in winter weather, when steam locomotives have their greatest troubles. These electric locomotives operate on the same principle as the small motors used on electric street and elevated railways (*see* Electric Motor; Street Railways). With the anti-smoke campaigns being waged in the great cities and with the approaching exhaustion of the country's coal supplies, it is likely that steam will more and more be replaced by electric power.

With the running of many trains over a system, operation becomes very complicated. There is danger of a fast train overtaking a slower train, as well as danger from collision of trains going in opposite directions. Parallel tracks with switchovers and passing tracks are built beside the main line so that trains going in opposite directions may pass, and also to permit a train to run around a slow train going in the same direction. The basis of operation is the train schedule, which shows the exact time each train

A HOSPITAL FOR "SICK" LOCOMOTIVES

This is the main machine and boiler room of a repair shop at Topeka, Kan., maintained by one of the transcontinental railroads. As a rule, a locomotive is overhauled after every run, so that its "insides" will function properly. In the foreground you will notice a trough or "pit" in which men stand when working on the under side of an engine.

RIVALS OF THE ROAD—STEAM AND ELECTRICITY



These giant locomotives represent the highest development in their respective fields. The electric locomotive above was specially designed for service on steep grades in the Rocky Mountains. Below is one of the latest types of steam locomotive designed for exceedingly slow, heavy pulls. Powerful as is this 800,000-pound monster, its electrical rival can outpull it.

is to leave the terminus and pass each station on the line. But more than this is necessary, for trains cannot operate exactly on schedule time. Delays may be caused by accidents, severe storms, icy rails, or snow drifts, and by many other causes. Freight trains will vary in their speed according to the weight of the load and the time required for loading and unloading at the various stations. It is also necessary at times to operate special trains.

The safety of a train in operation is largely in the hands of the train dispatcher—a man who sits at a table in the central office with a large train sheet spread out in front of him. On this is indicated the position of every train operating over the line. As the train leaves the station, the number of the cars, the names of the crew, the number of the locomotive, the time of leaving the terminal, and other significant facts are recorded on the sheet. As it passes each station the time is telegraphed to the dispatcher, who thus knows the exact location of every train at any time. If delays or accidents make a change from the regular schedule necessary the dispatcher makes up the special orders for the trains affected and telegraphs them to the stations toward which the trains are running.

At grade crossings, diverging lines, and similar points, trains are protected by "interlocking plants." Attached to the signal and switch levers controlling movements on each line is a combination of locking bolts and bars. These locks make it impossible to give a "clear" or "proceed" signal to the line unless all the switches and signals are set against the other line. Thus it is impossible for a towerman to set switches and signals in such a way as to bring about a collision. As an additional precaution a "derailing switch" is provided, and a "clear" cannot be given one line unless the "derail" is set against any train which may try to cross on the other line.

A RAILROAD THAT TAKES TO THE WATER

In the early days of railroading, when a train came to a body of water too wide to bridge, the passengers got off, took a boat across, and boarded another train on the other side. Now, as this ferry between Windsor, Ontario, and Detroit shows, the whole train can board a ferry boat, and the passengers need not even leave their seats. When the boat reaches the opposite shore, a new locomotive picks up the train, and off it goes again.

As an additional protection, the block system is required by law in some states, and is in general use on all up-to-date lines. Under this system the road is divided into "blocks" or sections of from a half-mile to two miles in length, the blocks being shorter over the lines of heavy traffic. The safety of the system lies in the fact that only one train on a track is permitted in the block at a time. Signals are set at the entrance to the block to indicate whether or not the block is clear. These signals may be operated automatically by an electric circuit, which is closed when a train enters and opened as it leaves the block; or they may be operated by a towerman on duty in each block. A towerman has before him a diagram of the tracks in his block, with small lights showing the position and movement of all trains on the tracks. He telegraphs the man in the next block what train is approaching and over what track, and in turn is advised of the movement of trains coming into his block. He is responsible for setting the signals correctly. The engineer is responsible for running in accordance with orders and signals. If the signals do not indicate a clear block ahead, he must stop his train until the clear signal is given.

At points of great traffic congestion, as at the Grand Central Station, New York City, still more elaborate provision for safety is necessary. The suburban and express trains at the Grand Central come in on different levels, and the trains on each level are controlled by electrical machinery. The machine that controls suburban train movements is the largest ever constructed; each of its 400 levers operates a switch or signal. A machine with 362 levers operates the switches and signals on the express level. The machines are operated by a crew of men, each of whom is responsible for 40 levers, and all working under a train director, who determines the track for each train to use.

For convenience in operation an extensive railway line is marked off into divisions. At the end of a division, a change is made in train crews and locomotives. This is done so that the men are not kept on duty an unreasonable length of time. The time that an engine can remain in continuous service is also limited, for after a run over a division, the firebox must be cleaned out and the engine thoroughly cleaned and oiled.

In addition to operation over the main lines, a great deal of work is done over tracks in the switch-yards and terminals. In the "yards" one sees what appears to be a hopeless confusion of cars moving over a maze of tracks. But they are really orderly movements, under the direction of a yardmaster and the switchmen. Here the cars are received and sorted by switching them to the proper tracks. The empties are put in one place, while the loaded cars are sorted according to their destination and also as fast or slow freight. Then the freight trains are made up and pass out to the main lines, often with 100 or more cars in a single train.

A great improvement made in switching yards is the "hump" or "gravity" yard. The main switching point is built on top of high ground, and the trains to be cut up are brought to this "hump." The cars are then detached from the train, and allowed to roll down hill into their proper sidetrack. A brake-man stops them at the proper point. In the best yards, such as the one at Clearing near Chicago, the switches are electrically controlled from a tower erected over the "hump." Most large cities also have one or more "belt railways" which encircle the city. Incoming trains are cut up and the cars destined for other lines are delivered over the "belt line," and only those cars destined for some point in the city are taken in.

In the United States the highest long-distance speeds are those made by the crack special trains between Chicago and New York. This run of approximately 1,000 miles is made by the "flyers" in 18 hours, or an average speed of 55 miles an hour; portions of the run may be made at a speed exceeding 70 miles an hour. There was at one time much competition between roads in cutting down the time of runs made by their special long-distance trains, but the later and decidedly more wholesome tendency has been to strive for safety rather than for high speed.

Heavy freight trains are most economically moved at a rate of from 8 to 14 miles an hour. This is called "drag freight." Such service, of course, cannot be used in bringing California apricots or fresh Florida garden truck to New York; but for non-perishable goods like coal, ore, and lumber, not required for prompt delivery, it is the cheapest form of rail transportation.

Handling Passengers and Freight

Passengers and freight come from everywhere and go everywhere, on journeys short or long, over one line or transferring over a number of lines. The passenger tickets and the bills of lading for freight assist in the orderly routing of traffic and also serve as a record of business done by the different roads. The long "coupon" tickets, used where the passenger is carried over several different roads or divisions, are to assist the railroad auditors in dividing the revenues among the different roads.

When freight is received at a station, a bill of lading is made out giving the starting point, the destination, and the routing, a description of the freight, and the rate to which it is entitled. If it is routed over more than one line a record is kept at transfer points. A small amount of freight—less than a carload—will be reloaded at the junction point to a car of the other road. But carload freight is simply shunted from one road to another. A car may travel in this way over many lines, and even be reloaded with freight of other roads; but a record is kept of its travels, and if it is used by another company, payment for its use is made to the owning line.

Freight charges are more complicated than charges for any other branch of railroad service. All freight is classified according to the work and care required of the railroad in its transportation. This depends upon whether it is live stock, fragile commodities, heavy, bulky, crated, perishable in heat or cold, fast or slow freight, in carload or less than carload lots, and on similar considerations. Each class takes a different rate, which is modified by weight and distance carried. Passenger charges are much more simple, being in the main a straight rate of so much per mile for one-way travel in day coaches. Reduced rates may apply to certain kinds of travel, such as excursion and round-trip tourist travel. Extra fare is charged on the luxurious fast trains, and on long distance runs; and separate charges are made for special accommodations in sleeping and parlor cars. The express companies have contracts with the railroad companies for carrying express, while mail is carried by agreement with the government.

The Cost of Moving Freight

Various units—the train mile, the car mile, and the ton mile—are used as a basis in estimating the cost of moving freight. The ton mile, or the cost of moving one ton one mile, is generally regarded as the most scientific basic unit. In computing the cost of passenger service, the unit is the cost of moving one passenger one mile. On most roads in the United States, receipts from passenger fares form less than a third of the total revenues from operation. Passenger train miles, however, form fully half of the total train mileage.

The whole matter of rates and service is so vital to the commerce and industry of the country that it is made the subject of government regulation. Interstate commerce is regulated by the United States government through the Interstate Commerce Commission (*see* Interstate Commerce Commission) and various boards and commissions dealing with different phases of railway management and operation. Each state has the power of regulating railways within its borders, and usually does through a commission composed of several members. Cities have no rate-regulating power, but exercise control over such matters as track elevation, gates at street crossings, avoidance of undue noise and smoke, and the speed of trains within the city limits.

There are many advantages in having the railroads of a country operated as one unified system. This is secured in many countries by government ownership of the lines. During American participation in the World War, the United States government took over the operation of the roads, to speed up transportation of troops and war materials. At the end of the war the railroads were returned to private operation.

The Mighty Army that Runs the Road

What a mighty army it would be if all the 1,700,000 railway men and women could pass in review before us! First would come the surveyors, the construction engineers, and the laborers who prepare the roadway, with their wonderful machines capable of laying two or three miles of track in a day. Then would follow the men who keep the tracks in repair, with their tens of thousands of hand-cars. Giant snow plows used to clean the track after the winter blizzards, and wrecking crews with their machinery for clearing tracks in case of accidents would accompany them. Those who built the great locomotives and railway cars would come next, with numerous companies of caretakers and repair men to keep them in working condition. The vast regiment of men in charge of the trains would make up the main body of the army—men trained to prompt and faithful service, alert and watchful over the lives and property in their keeping, and heroic and unhesitating in obedience to their orders. Here, too, would march the train dispatchers and the telegraph operators, while from the stations would come the station masters and train masters, with ticket agents, cashiers, and a host of typists and assistants. From the main offices would come the men who do the important work of purchasing the supplies, others who look after securing business for the road and distributing rolling stock where it is needed by the shippers, and the large organization needed to keep track of the expenses and revenues of the railroads. Truly a vast amount of money goes into the building and operating of the railroads—more than four billion dollars a year in the United States alone—and a mighty host is busied with its ceaseless tasks!

RAINBOW. No doubt you have heard the story of the foolish children who set out to find the end of the rainbow, believing that there they would find a pot of gold. But they never got to the end, because the rainbow is merely the result of refraction and reflection of the sun's rays from the backs of countless raindrops in the sky.

Rainbows are seen, you have noticed, when the sun is shining behind you and rain is falling in front of you at a distance. To understand how the beautiful arch of many colors is formed you will have to read the articles on Light, and Spectrum and Spectroscope. That tells you why a ray of light passing through a three-sided piece of glass is bent, or refracted, so that the seven colors of which white light is composed are all sorted out, separate and distinct. Now much the same thing happens when you see a rainbow. The raindrops act as nature's prisms. The rays of the sun are bent as they enter the raindrop, then reflected from the back of the drop, and then bent again as they pass out. The result is that they are broken up into the seven prismatic colors, which we see as a rainbow.

Frequently two rainbows are seen at once, one inside the other. The outer bow, which is the result of a double reflection within the raindrops, is fainter than the inner bow, and the order of the colors is reversed.

On any sunny day you can produce your own rainbow with a lawn sprinkler, or by throwing a stone into the water so that it makes a big splash. When the sun is in the right position beautiful rainbows are also seen in the spray of Niagara Falls and other great waterfalls.

In bygone ages men were greatly perplexed by the rainbow, and not understanding how it was produced they invented fables to explain it. The ancient Greeks used to imagine that it was a sign placed in the heavens by the gods to foretell war or heavy rain. The slender golden-winged Iris was the goddess of the rainbow, who bore messages from the gods to men. The Norsemen believed that the rainbow was the bridge over which the gods passed from earth to their home in the sky.

The DROPS *that* WAKE *the* FIELDS *to* LIFE

What Science Tells Us about Rainfall All around the Globe—The Golden Mean in the Matter of Moisture—Service of the Winds and the Mountains, the World's Great Rain-Makers

RAINFALL. The very life-blood of field and farm is rain. The richest land in the world is worth just exactly nothing at all for agriculture without rain or irrigation, which is only an artificial distribution of rainfall. A square mile of land in South Australia, with 8 or 10 inches of rain a year, will support 8 or 9 sheep; a square mile in Argentina, with 34 inches of annual rainfall, will support 2,630 sheep.

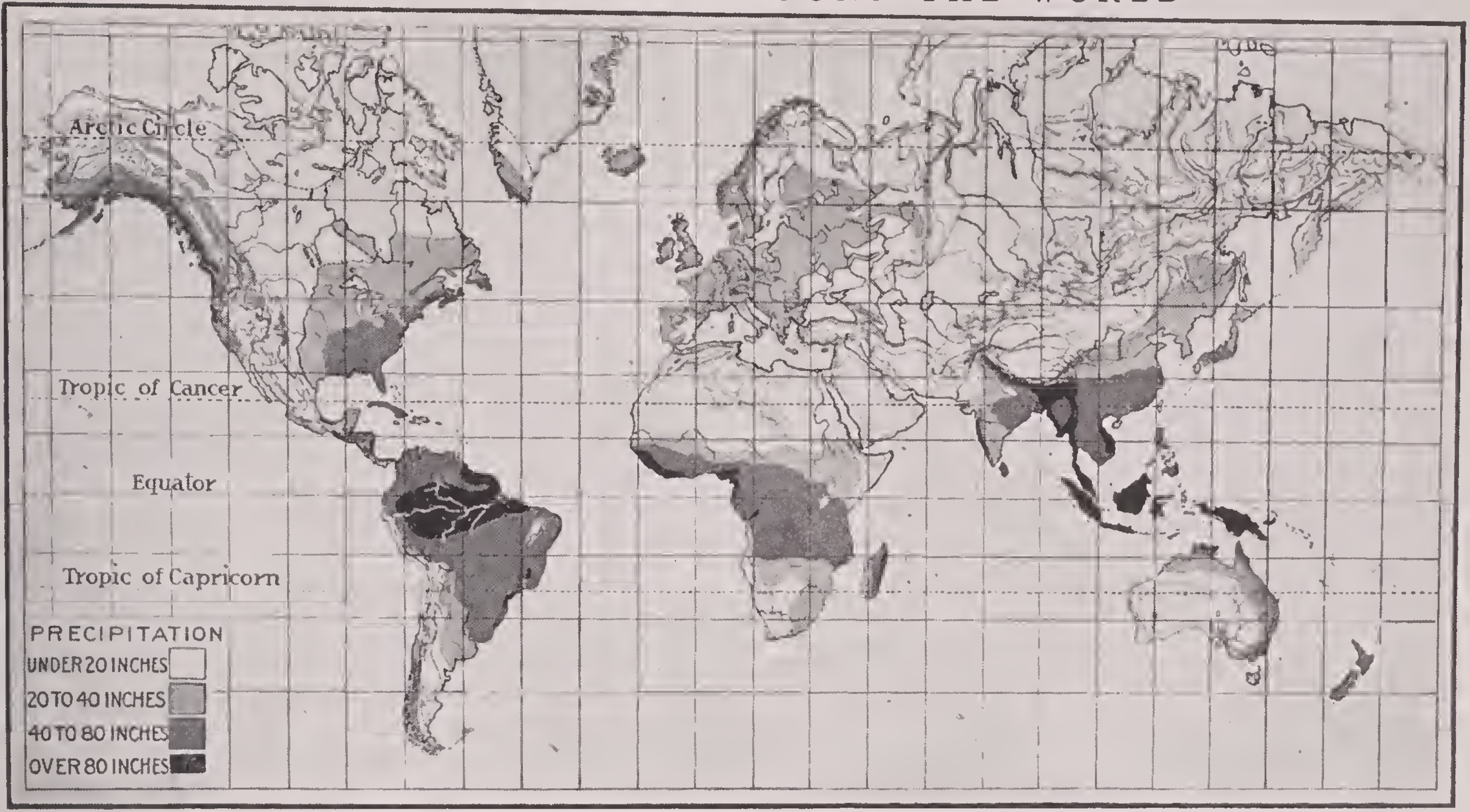
In general, 20 inches of rain is considered the minimum for ordinary agriculture (without irrigation), though 10 inches is enough if the farmer can have it distributed just when and where he wants it. That is, to produce an acre of corn (say 50 bushels) an acre of water 10 inches deep is needed—not all at once, of course.

Human beings and the majority of the plants and animals which are most useful to them flourish best where rainfall is neither excessive nor scanty. Men exist in discomfort in Cherra Punji, India, with its 450 inches of annual rainfall, and also on Walfisch Bay, West Africa, with its 0.3 inch. The regions of moderate and regular rainfall, in general, support the largest and most prosperous populations.

Vegetable life varies even more directly with the amount of rainfall. It becomes scanty or extinct in dry regions, such as the Sahara and central Australia; it grows sturdy and abundant in regions of moderate evenly distributed rainfall, like the greater part of Europe and the eastern United States; while in excessively moist regions—the Amazon basin, for example—its wild rebellious luxuriance is almost beyond human control.

Rainfall depends, first of all, on evaporation, and then on wind. The wind carries water vapor unchanged until condensed through cooling. In the belt of calms or "doldrums" around the Equator the moist air rises and cools and the moisture becoming condensed falls in heavy thundershowers (*see* Storms). These occur nearly every afternoon all the year round,

HOW RAIN FALLS AROUND THE WORLD



You will notice that the regions of heaviest rainfall, over 80 inches a year, are all situated either in the neighborhood of the Equator or on the seaward side of great mountain ranges. The Amazon valley, the west coast of Africa, and the islands of the East Indies are examples of how moisture-laden air rises above hot land masses, becomes cooled in the upper altitudes, and drops its moisture in the form of violent showers. The northwest coast of North America and northeastern India show how damp winds from the sea strike cooling mountain ranges and precipitate their abundant moisture.

so that the rainfall may be well above 100 inches a year. Tropical South America and Africa owe their heavy rains to this cause. Thundershowers occur almost everywhere on the surface of the earth, but are fewer as one travels away from the Equator. They add considerably to the rainfall of the United States during the growing season.

The trade winds are rainless when they rise on land and blow toward the sea. They are traveling toward the Equator, are being heated, and consequently are gathering, not losing, moisture. Only when they blow inland and are forced to rise over a mountain range are they cooled sufficiently to cause rain. Some of the driest regions of the earth lie within or on the margin of the trade wind belt—the Sahara, Arabia, central and western Australia, the southwestern United States, and Lower California. So also do some very moist regions, as the heights of Asia and the islands of the East Indian Archipelago.

Rainy Days and the "Westerlies"

To the region of prevailing westerlies, rain is brought by (1) thundershowers, (2) warm south winds drawn in by the cyclonic storms, and (3) the prevailing west winds from the oceans, which drop their moisture when they are cooled on rising over mountains or on passing over surfaces cooler than they are. Oregon and Washington, the southern part of Chile in South America, have heavy rainfalls because of this cooling. The enormously long desert in South America along the west coast, extending from 5° S. latitude to 30° S. latitude, or more than 2,000 miles, is due to the opposite phenomenon. Instead of being cooled on reaching land, the air is warmed.

Of the rain-bringing winds in the belt of the prevailing westerlies, the cyclonic storms have the far more beneficial influence. Their rains are for the most part more gentle, less heavy, and are better distributed throughout the year. They have, too, what is known as a "rhythm" of rain and sunshine, which is essential for the proper ripening of cereals, especially wheat, which rots if it has too much moisture in the growing season. Thus the Mississippi valley (northern section), Russia, Siberia, France, Hungary, and Argentina are ideal cyclonic storm wheat regions. Portions of these same regions are situated so far inland that they never receive any of the moisture from the south winds. Or they may be so heated by the sun that they tend to warm the winds and prevent precipitation until they rise over mountains.

The earth's water-carriers, winds, it will be seen, must first have a chance to draw water, and then be forced by cooling to deliver their load. Mountain ranges are particularly efficacious in making the winds "stand and deliver," and therefore every great mountain range has a wetter side to windward and a drier side to leeward. Sometimes one face receives ten times as much rain as the other. Because the winds which visit high plateaus like those of Colorado, Bolivia, Peru, Tibet, and Khorassan have been robbed of most of their moisture before they reach the heights, these regions are always dry—excessively so if walled in by mountains.

The season of greatest rainfall is very important. The eastern United States and western continental Europe receive their greatest rainfall in summer. Scotland and the greater part of the Pacific coast have their heaviest rain in winter. On the Mediterranean coast most rain falls either in winter or in spring and autumn. Some regions, such as Central America and equatorial South America, equatorial west coast of Africa, Ceylon, and Siam, have two rainy seasons a year. The regions of heavy rainfall, such as the states of Washington and Oregon, incline to reckon their seasons as wet and dry, rather than hot and cold; but the islands of the East Indian Archipelago, which are among the world's wettest places, have two seasons of heavy rain and no dry season at all. On the coast of Peru, in the valley of the Colorado, the Sahara and the Gobi deserts, rain seldom or never falls; in Patagonia it rains nearly every day.

"Wet" and "Dry" in the United States

The eastern portion of the United States (rather more than half) receives from 20 to 80 inches of rainfall annually. The western portion, except for a moist fringe on the Pacific coast, which runs as high as 138 inches, receives an average of less than 20 inches.

Taking the lands of the world as a whole, Europe and the eastern United States, each with an average moderate rainfall—that is, from 20 to 80 inches annually—are nearly encircled by a belt of drouth, beginning with the Sahara, Arabia, and Persia, swinging northeastward through Tibet, Mongolia, Siberia, and Alaska (except the damp coastal fringe of the latter), then dipping sharply southward through western Canada and the United States, to end in Lower California and the Mexican plateau.

Around this belt of drouth runs a rainy belt which includes the world's dampest lands—the Pacific coast and the Aleutian islands, then southward in Asia to the belt of heavy tropical and equatorial rains running around the world through the East Indies, Indo-China, India, the Congo and Amazon basins, the West Indies, and Central America.

Rainfall may be measured by catching it in any flat-bottomed, perpendicular-sided vessel, placed exactly level where it will receive the full average rainfall, and measuring the depth with a very thin ruler—a thick one would raise the water level. As it is difficult to measure small amounts accurately, a special rain gauge has been devised, with a funnel and an inner can so proportioned that each inch of water in it stands for one-tenth of an inch actual rainfall.

RAISINS. The dried fruits of certain varieties of grape containing 23 to 34 per cent of sugar are called raisins. Raisin grapes are grown chiefly in the Mediterranean countries, California, and Australia. Since the drying is done in the sun, the raisin industry is confined to regions which have several weeks of rainless weather. Some of the finest raisins from the Mediterranean are obtained by letting the grapes dry on the vine, partially cutting the stem of each cluster to reduce the flow of sap. More often they are cut from the stem when ripe and laid on trays in the sun for about two weeks. Then they are sweated for a few days, and seeded and packed by machinery. The chief varieties of grapes for raisins are the muscatel or muscat and, in the United States, Thompson's seedless. The Sultana raisins are obtained from small seedless grapes of Greece and Asia Minor. (*See* Grapes.)

MANY-SIDED RALEIGH *and His* VISIONS

Disappointment in His Colonizing Ambitions in America—What He Really Accomplished—His Fall from Court Favor, the Long Years in the Tower, and His Tragic End

RALEIGH (*rạ'lĕ*), SIR WALTER (1552–1618). Politician, soldier, sailor, explorer, poet, and historian, this popular hero stands out as an illustrious example of the many-sided genius of the men of Queen Elizabeth's time, and of the stirring and adventurous life of the day. But his greatest title to fame rests on his efforts to colonize the New World. His was the vision of a new England beyond the seas, a vision which made an irresistible appeal to an intellect among the keenest and an imagination among the boldest of a time which abounded in keen intellects and bold imaginations. And he strove to realize this vision through many weary years of failure and disappointment.

Born at Hayes, Devonshire, in 1552, Raleigh entered Oriel College, Oxford, in 1568, but left the next year to fight on the side of the Huguenots in France. In 1580 he distinguished himself in the suppression of the Irish rebellion in Cork, and soon afterward was introduced at court and became a favorite of Queen Elizabeth. You remember the story of how he won the queen's favor by throwing his costly velvet cloak on a muddy spot to enable her to walk over it dry-shod.

Raleigh's tall and handsome figure, his dark hair, lofty forehead, resolute bearing, courtly manners, and spirited wit combined to form an imposing personality; and all the advantages that Nature had given him were heightened by a gorgeous splendor in dress and jewels. But he was proud, haughty, and impatient, and so made hosts of enemies and was never fully admitted to the Queen's counsels in matters of state. The playful name of "Water" which she applied to him would indicate that she appreciated that instability of character which was his great fault and in the end worked his ruin. Elizabeth, however, lavished numerous favors upon him throughout her reign, and he discharged the responsibilities of several important positions to which she appointed him with conspicuous ability.

RALEIGH IS CHARMED BY 'THE FAERIE QUEENE'

In 1588 or 1589, while in Ireland, Raleigh made the acquaintance of the poet Edmund Spenser. The artist has pictured a scene in Spenser's castle, when the poet is reading to the courtier his great poem, 'The Faerie Queene'. So delighted with the work was Raleigh that he used his influence at court to obtain a pension for Spenser and also obtained financial help from Queen Elizabeth for the publication of the poem.

Even before Raleigh appeared at court he had been interested with his half-brother, Sir Humphrey Gilbert, in a colonizing venture to Newfoundland. Up to that time England did not own a foot of land in America. Raleigh's new position at court gave him increased wealth and opportunity to push his great project, although the queen would not let him lead any of his colonizing expeditions in person. Raleigh was tireless in his efforts to plant "our people in America," and sent out expedition after expedition. The name of "Virginia," honoring the "Virgin Queen," given to the area explored by one of his expeditions (1584) alone remains to testify to his efforts, for none of his colonies survived. (For the story of the Lost Colony of Roanoke, *see* North Carolina.) Nevertheless the pioneer work of Raleigh paved the way for the later colonists who were successful. Curiously enough, too, by making the smoking of tobacco popular he helped create a demand for the plant by the culture of which the colonists later found a sure road to wealth.

Raleigh was in Ireland when the Spanish Armada (1588) appeared in English waters, but he hastened to England and as vice-admiral of Devon he had his share in the work of that exciting time (*see* Armada). In the years which followed he took part in various expeditions against the Spaniards. In 1595 he sailed at the head of an expedition to Guiana, in search of the fabled El Dorado, and on his return empty-handed, after much hardship and suffering, he wrote 'The Discoverie of Guiana', one of the most fascinating of Elizabethan narratives of adventure. Next year (1596), Raleigh sailed in the expedition under Howard and Essex to Cadiz, and although he was seriously wounded, it was his counsels that governed the whole plan of action which for a second time shattered the naval power of Spain.

Raleigh's popularity at court had been waning since his marriage to one of Elizabeth's maids of honor, which enraged the jealous queen. With the accession of James I (1603) complete disaster overtook him. The Scottish king suspected that Raleigh had worked against his becoming king of England, so he stripped Raleigh of his numerous offices and privileges. In anger Raleigh then took some part in one of several plots of the time, and was arrested and tried on a charge of conspiring against the king's life. Although no satisfactory evidence could be produced, Raleigh was condemned to death and only on the scaffold was his sentence commuted to imprisonment for life. His admirable bearing during the trial turned public opinion in his favor. One of his enemies said: "When the trial began I would have gone a thousand miles to see Raleigh hanged; before the trial closed I would have gone a thousand miles to save his life."

The next 13 years Raleigh spent in the Tower of London, where he was visited by many of the great scholars and poets of the day. Most of the time his wife and son were permitted to live with him. During this period he worked on a 'History of the World' for King James's son, Prince Henry, whose favor he enjoyed. Three volumes of this work, down to 130 B.C., were finished and, when published, were widely read. Raleigh also had written verses of good quality, and a good deal in the way of political philosophy.

Raleigh finally persuaded the king to release him in 1617, on condition of leading an expedition to the Orinoco River and bringing back some of the gold from a mine he said he had discovered on his previous expedition. He pledged himself not to come into collision with Spain, though this evidently was an impossibility; some of his men, while he was sick aboard his ship, attacked a Spanish village and burned it to the ground. Raleigh returned to England without finding the mine, to face the enraged protests of Spain. King James basely re-arrested him and had him executed (1618) under his old sentence, which had never been revoked. Cheerful and resolute to the last, when Raleigh was led to the scaffold he asked to see the ax, and, touching the edge, said: "This is a sharp medicine, but it is a sure cure for all diseases." Thus died the man who gave the first great impulse to the movement of English colonization which produced the United States.

RAPHAEL SANTI
Most Beloved of All Painters

RAPHAEL (*răf'ā-ĕl*) **SANTI** (1483–1520). "Let him be my pupil; he will soon become my master," said the Italian painter Perugino, when he saw the work of the boy Raphael. He spoke the truth, for Raphael became the master painter of his time and even today is the most generally praised, and certainly the most beloved, of all the painters of the world.

"He is an innocent angel," Pope Julius II exclaimed as the beautiful Raphael, his chestnut locks falling upon his shoulders, knelt before him. This was when Raphael, 25 years of age, was beginning the most important work of his life, the execution of those numerous wall paintings which still decorate the halls and chambers of the Vatican or palace of the pope in Rome. Vasari, who tells us so many stories of the lives of these old-time artists, says of Raphael and his numerous assistants, at this time: "He was never seen to go to court but surrounded as he left his house by some 50 painters, all men of ability and distinction, who thus attended him to give evidence of the honor in which they held him. Among them there was no rivalry or jealousy, for all became of one mind, once they began to labor in the society of Raphael, every vile and base thought departing from the mind before his influence." To all of these pupils Raphael was as a father.

But though princes considered themselves favored if this young artist even designed a picture for them, and though his students and assistants bowed before him as before their sovereign, Raphael always thought of himself as a pupil learning from the works of others how to make his own art more perfect. From his boyhood days in the studio of his father in Urbino, on through the years with Perugino, the wonderful days in Florence with Leonardo da Vinci and Michelangelo, in Rome at the height of his powers—everywhere he found some point which he could use. In part it was this purity and fineness of his spirit that have made his work immortal. His maxim was, "We must not represent things as they are, but as they should be." So whether he painted an altar-piece for a church, a great fresco of Bible history or classical mythology, or made a pattern cartoon for a tapestry, the picture was sure to be beautiful. How completely he succeeded in this is shown, for example, in his picture entitled 'The School of Athens', which is only one of four great wall paintings with which he beautified a single one of the pope's rooms in the Vatican.

Raphael also painted more than a hundred pictures of the 'Madonna', or Virgin Mary. Do you know the one called the 'Madonna of the Chair'? It is told that passing along the street one day Raphael saw an Italian mother in the picturesque costume of the Roman people, with her baby in her arms. He was struck by the picture she made sitting there before her doorway, and seizing the cover of a wine cask near by, he made on it a pencil sketch for this famous painting. His 'Sistine Madonna' (so called because it was painted for an Italian church dedicated to Saint Sixtus, but which is now in the Dresden Gallery) is one of the greatest pictures in the world. When the great painter Correggio stood before it he exclaimed with pride, "I too am an artist!" But others besides artists are affected by this painting. Crossing the threshold into the room where it stands alone, amid hangings of black velvet, the most frivolous become touched with awe.

Raphael died at the early age of 37, yet he left an amazing amount of work. The wall paintings which he designed for the Vatican alone might have been the work of a lifetime, but besides these there are hundreds of pictures and studies. And throughout all, there is not an expression of the face or a drapery which is not exactly suited to its purpose, nor in the thousands of figures which he drew is there an ungraceful line or pose. Other artists have drawn well, others have equally mastered color, others have shown greater power and grandeur in conception; but none before or since has shown such surpassing skill in picturing the ideal, the spiritual, the beautiful, as Raphael of Urbino.

He is one of the three great painters in whom the Renaissance flowered with a glory even beyond the promise of its budding. His last days were devoted to his great picture of the 'Transfiguration'. He finished the upper part of the picture, but as he sketched the lower half a deadly fever stayed the active hand and ended the work of this master.

To form an adequate idea of the works of Raphael one must visit Rome, but many of the galleries of Europe contain examples of his art. The National Gallery, London, has the beautiful 'Saint Catharine', and one of his early Madonnas is to be seen in the Metropolitan Museum in New York City.

RASPBERRY. The raspberries in the fruit gardens of today are the cultivated descendants of the wild briar patch or "bramble tangle." A great many different varieties have been developed and improved from both European and American wild species.

The "black cap" or black raspberry is a native of America, as is also the most widely distributed variety of red raspberry. The European red, which has been cultivated for several centuries in England and was one of the earliest fruits introduced into the United States, furnishes a superior berry but is adapted to the home garden rather than to commercial fruit growing. It is not so hardy as the American red, and instead of ripening for one marketable crop the berries ripen a few at a time, supplying the home table over a longer period.

A cross between a black and red variety produced the large loganberry which is black tinged with red and with the flavor of the red. Burbank crossed the native dewberry, a fine flavored blackberry, with a red raspberry and produced a berry even superior to the loganberry, which has been given the name "Phenomenal." Another of his successes is the "Primus," a hybrid of a blackberry and a raspberry which bears fruit almost as large around as a penny, especially sweet and fine flavored.

The raspberry, which like the blackberry belongs to the genus *Rubus*, is distinguished from the latter by the fact that the ripe fruit comes off the stem like a small cap or thimble. The raspberries are propagated by root cuttings and by "layering," which means covering the branches with soil to induce them to take root. The black-cap raspberry forms new plants from the tips of the branches that bend over until they touch the ground and take root. Most of the garden varieties have very plain white flowers, but some of the wild raspberries are very ornamental in cultivation.

RAT. If you were asked to name the most destructive animal in the world, what should you answer? It might never occur to you to name the right one—the little despised rat, the king of destroyers! A distinguished biologist, who has studied the rat very carefully, says:

"The rat is the worst animal pest in the world. From its home among filth it visits dwellings and storerooms to pollute and destroy human food. It carries bubonic plague and many other diseases fatal to man and has been responsible for more untimely deaths among human beings than all the wars in history. In the United States rats and mice each year destroy crops and other property valued at over $200,000,000. On many a farm, if the grain eaten and wasted by rats and mice could be sold, the proceeds would more than pay all the farmer's taxes. The common brown rat breeds 6 to 10 times a year and produces an average of 10 young at a litter. Young females breed when only three or four months old. At this rate a pair of rats, breeding uninterruptedly and without deaths, would at the end of three years be increased to 359,709,482 individuals.

"Rats are omnivorous, feeding upon all kinds of animal and vegetable matter. The brown rat makes its home in the open field, the hedge row, and the river bank, as well as in stone walls, piers, and all kinds of buildings. It destroys grains when newly planted, while growing, and in the shock, stack, mow, crib, granary, mill, elevator, or ship's hold, and also in the bin and feed trough. It invades store and warehouse and destroys furs, laces, silks, carpets, leather goods, and groceries. It attacks fruits, vegetables and meats in the markets and destroys by pollution ten times as much as it actually eats. It destroys eggs and young poultry and eats the eggs and young of song and game birds. It carries disease from house to house and bubonic plague from city to city. It causes disastrous conflagrations; floods houses by gnawing lead water pipes; ruins artificial ponds by burrowing; and damages foundations, floors, doors, and furnishings of dwellings."

An Unwelcome Immigrant.

The common house rat, known as the brown or Norwegian rat, was introduced into America from Europe shortly before the Revolution and has since spread over the continent. It is about nine inches long not including the tail. The black rat is smaller and weaker and flees from the brown rat, which is very aggressive. The wood, trade, or pack rat is noted principally for its amusing pranks. It is found in the southern part of the United States and on the Pacific coast from British Columbia to Central America. The cotton rat, found in the cotton belt, is a vicious and destructive animal. The coypu rat of the West Indies and Central and South America is the largest of the rats, attaining 20 inches in length and a weight of 8 pounds. The hamster of the northern parts of Europe and Asia, which is about a foot long, is a terrible pest to farmers. The kangaroo rat found in the southwestern part of the United States, is a gentle, harmless, handsome creature. It has short forelegs, long hindlegs, a long tail ending in a tuft, and it jumps like a kangaroo. It possesses cheek pouches for collecting food. A similar animal found in the sandy plains and deserts of Asia, eastern Europe, and northern Africa, is known as the jerboa, and is remarkable for the long leaps of which it is capable in escaping its foes.

In getting rid of rats the average cat or dog is of little service; and the difficulty with most rat poisons is that the rats will not eat them. They will not touch food that smells strongly of human beings or that is not attractive to them; nor will they eat poisoned food if other food can be easily got. The United States Health Service advises a 10 per cent mixture of arsenious acid or phosphorus, with cheese, meal, or glucose. On the whole, traps are most successful, steel traps being better than cage traps. But the trap must be well "camouflaged," and baited with the food found in the vicinity—grain in a grain house, meat in a butcher shop, and so on. Traps must not be kept too clean, and must not be left in position longer than a day. The best method of combatting rats, however, is rat proof construction, especially cement.

RATS KEEP OFF!

Rats carry diseases, notably the deadly bubonic plague. To keep them from boarding ships or coming ashore from infected vessels, disks like the one shown here are placed around the mooring cables.

The name "rat" is applied in the stricter sense to large rodents of the mouse family (*Muridae*), and especially to members of the genus *Mus*, as the black rat (*Mus rattus*) and the brown rat (*Mus decumanus*). In a wider sense it is applied to certain rodents which are not *Muridae*, as the kangaroo rat and the coypu rat.

RATTLESNAKE. After all, the rattlesnake is a gentleman outlaw! He rarely strikes without warning, and then it is in self-defense. A curious rattle on the tail, which acts as an automatic danger signal, gives this group of about 16 species its name.

This rattle is formed of a number of hard, horny, cup-shaped joints, fitting loosely into each other. When the sensitive tail is vibrated by the nervous excitement of the snake, these strike together and give a rattling sound that may be heard for 20 yards.

Young snakes have only a blunt tip at the end of the tail formed by a knoblike growth of bone that is covered with thick skin. When the snake moults, or sheds its skin, this horny tip is retained and forms the first joint of the rattle. A new joint is added each time the skin is shed, and, as the snake grows larger, each joint is correspondingly larger and so causes the rattle to conform to the tapering shape of the snake. It is said that the joints of the rattle represent the years of the snake's life, but this is not always true, for well-fed snakes often shed their skin several times in a year, and furthermore the joints of the rattle often become worn and drop off. Specimens with more than 20 rattles have been found.

The rattler can strike effectively only from a coiled position, and then can reach only about two-thirds the length of his body. Usually the snake will sound his rattle and puff up and hiss before striking, hoping to drive away the intruder. But when the blow finally falls, it comes with the speed of lightning. The fangs, projecting almost straight out from the wide open mouth, sink in, driving home their poison. If the poison fails to stop the heart action of the victim, its peculiar quality frequently causes death by gangrene poisoning.

The different species of the group, which belongs entirely to the New World, are all of the sub-family of pit-vipers, which means that they all have a deep depression in the side of the head between the eye and the nostril. The use or the cause of this pit is unknown. The habits of the species are similar. They are not vicious, but rather sluggish, and will slink away unless molested. When cornered they rattle and puff threateningly as if to frighten their foe. A rapid movement will provoke them and then they strike with fury. All species feed on rats, mice, and other small rodents. The young are born alive in late summer, and have the full poison equipment at birth.

The worst enemy of the rattler, aside from man, is the hog. They root the snakes out and make a meal of them, apparently with no bad results from the bite that may be inflicted. This is because the pig's tough skin and layer of fat under it does not allow the poison to enter the blood. The king and black snakes and certain birds of prey also eat the rattler.

As cold weather approaches, these snakes congregate in hollow logs, in caves, or under rocks and, winding themselves into a mass, sleep till spring.

The common or banded rattlesnake, found in the eastern United States, is of a bright tawny color marked with dark brown, and varies in length from 3 to 5 feet. It inhabits rocky and wooded places. The diamond rattlesnake of the Southern states grows to a length of 8 feet and is often 15 inches around. It is the bulkiest of all venomous snakes. This species lives in swampy places and swims well. Its yellowish body has plainly outlined diamond-shaped black blotches. The plains rattlesnake is a smaller, lighter-colored snake with less distinct markings, which grows to be about 30 inches long. It commonly makes its home in the burrows of the prairie-dog, where, an unwelcome guest, it ungraciously feeds on the young of its host. Other species are found in various districts of North and of Central America, and in parts of South America. Among the most curious is the "horned rattler" of the southwestern United States, which has hornlike cones above the eyes. It is also called "side-winder" from its peculiar habit of wriggling sideways over the ground. Most rattlers belong to the genus *Crotalus*, but the small ground rattlers are set apart in a separate genus, *Sistrurus*. Scientific name of common rattlesnake, *Crotalus horridus;* of diamond rattler, *Crotalus adamanteus;* of common ground rattler, *Sistrurus miliarius.* (*See* Snakes.)

Raven. The raven has a considerable historical background, for it was the first bird sent from Noah's ark, and it was the bird which fed the prophet Elijah. The raven was also the messenger of the Norse god, Odin, and its figure was on the flag that the early Northmen (Danes) carried into England. Some of the Pacific coast Indians place its image on their totem poles. Probably no bird is so widely mentioned in literature. Edgar Allan Poe in his poem 'The Raven' with its reiterated refrain of "nevermore" has immortalized this bird as the symbol of melancholy despair.

Ravens are found in almost the whole of Europe, in Africa, northern Asia, and America. With crows, jays, and magpies they make up the family *Corvidae*. Their somber black plumage adds to the age-old mystery surrounding them. They are as long-lived as man, and are perhaps the most highly developed of bird forms. Pairs mate for life and year after year use the same nest. They feed on small rodents and will eat the flesh of dead animals even when decayed. The raven's voice is harsh and croaking; but like the crow the bird can be taught to imitate sounds and speak a few words. In the United States ravens are found only in the west and southwest. They are common in Yellowstone and Glacier parks. Scientific name, *Corvus corax*.

THE BIRD OF MOURNING

Poe's famous poem has given the Raven a reputation as a melancholy bird, but really he is impudent, inquisitive, and mischievous.

Ravenna, Italy. This picturesque old city, lying in a marshy plain near the Adriatic Sea, 75 miles south of Venice, is interesting today chiefly for three reasons. The military expert remembers it as the scene of the great battle of Ravenna in 1512, in the Italian wars between France and Spain, and as the headquarters of a flotilla of American submarine chasers in the Adriatic in 1917–18 during the World War. The lover of literature sees Ravenna as the city where the poet Dante died and is buried. The artist and architect attaches importance to the city because nowhere else are there so many striking examples of early Christian and Byzantine architecture and mosaics.

In the days of Emperor Augustus, Ravenna was a great Roman naval station with a harbor capable of sheltering 250 ships, but today it is separated from the sea by six miles of marshy ground, traversed by an unimportant canal. The industries are few, consisting mainly of wine-making, breeding silkworms, and manufacturing lace.

The city presents a somewhat somber appearance, as if mourning for its glorious past. The most venerable of the churches is the cathedral of Sant' Orso, which dates back to Roman times, but which has been almost entirely rebuilt. There are 12 other churches or "basilicas" in Ravenna originally built between the 5th and 8th centuries, constituting a priceless architectural heritage of early Christianity. Another interesting historical monument is the two-storied tomb of the great Ostrogothic king, Theodoric, dating from about 520.

The Battle of Ravenna, which was one of the bloodiest ever fought on Italian soil, is interesting because of the employment of artillery mounted upon carts. In this battle the famous French leader, Gaston de Foix, defeated the superior forces of the Spanish and papal armies, but was himself killed. This battle is memorable as a forerunner of modern warfare, in which trained and specialized armies take the place of the haphazard methods of feudal days.

Ravenna was taken by Theodoric the Ostrogoth in 492, after a three-years' siege. For 200 years thereafter the city was the capital of the Exarchate of Ravenna, the last stronghold of the Eastern Emperors of Constantinople in Italy. It was taken soon after by Pepin, king of the Franks, who bestowed the entire exarchate upon the pope. In the later Middle Ages, however, Ravenna was ruled by tyrants of the Polenta family. When the lagoons on which Ravenna was built began to fill up, separating the city from the sea, it lost historical importance. In 1860 it became part of united Italy. Population, about 75,000.

DO YOU *Know How* TO READ?

The Art of Reading the Proper Books Properly—"Reading between the Lines" —How to Train the Eye and the Mind to Greater Speed

Reading. Perhaps you think you know all about reading, because you learned to read in the primary grades. Very few people know that there are new problems in reading to be solved, that even grown people may improve their reading in many ways. What shall we read? When shall we read? How may we learn to read faster and understand our reading better? These are our most important problems.

The boy Lincoln had serious struggles to get books to read, the boy Scott and the boy Stevenson browsed in large libraries. From Lincoln we may learn to choose the best authors; Scott and Stevenson teach us to read widely. There are many ways today to get books and to learn which books count for most. Teachers and librarians are most helpful; selected lists are published with descriptive notes to guide one in choosing, and many texts contain good bibliographies. (*See* American Literature; English Literature; Literature for Children.)

The ability to think of a book as a whole and to judge whether or not it is of value is well worth cultivating. Does the information in a book seem accurate? Is it given in an interesting way? Are the characters true to life? Are their actions natural? Do they stand for fine ideals of honor, of justice, of faith? Would you like to have them for friends? In the same way we need to learn which magazines and newspapers are worth reading. We need to read articles on both sides of the big questions of the day, especially on the side with which we are not likely to agree. Do you know which are the best magazines? Which newspapers have the most accounts of important happenings? Which ones give the fairest opinions in their editorials?

How to Make Books Talk

The best time to read is when one has questions to ask which the book or magazine can answer, or when one wants something interesting about which to think. Form the habit of always having books at hand which you are reading. Form the habit also of asking questions of the books as you read, of thinking ahead and wondering what will happen next. This will help you to get the thought better and to remember it longer. Ask yourself questions, too, when you have finished. What were the main points in this article? Why didn't the author have this story end differently? If you are already a pretty good reader, this may be the way in which you can best improve. Talking about the book with one's family or friends also helps.

Sometimes your books will disagree with one another or with your experience. Do you know more about the subject than the author does? That may be possible. How will you find out? Perhaps you are both right. "Reading between the lines" means understanding more than the exact facts on the page, means getting into the spirit of the author. Your reading will be richer if you can understand these hidden meanings.

The exact meanings of the words are necessary if your reading is to be helpful. Each word which is connected with your experience has that much more meaning. "Ocean" means more to a child who lives on the coast, "prairie" to one who lives on the low flat lands of the Middle West. Seek to add words to your vocabulary. To be rich in words is well worth the effort to acquire them.

Words have definite values in a book or article. Many times we skip over an important word, giving it less than its true value. This may turn good sense into nonsense. Strangely enough such little words as "if," "but," "not," are often overlooked altogether. In the same way we may give too great value to a word and so get the wrong idea of the sentence. We may even give too much meaning to part of a word and in that way become confused as to the sense of the passage containing it.

Few who read this article have difficulty in knowing common words, and most of you know how to attack a new word by the use of your phonic training, the help of a dictionary, or by fitting it into the sense. Many girls and boys do have such trouble, however, and they need to make lists of the words which bother them, mastering these words as soon as possible. To learn 50 words, or a dozen sounds, may clear up a boy's difficulties and change his whole attitude toward reading. Hunting in newspaper headlines and advertisements for words which one knows is another helpful way for improving one's recognition of words already known.

Probably the most surprising news for many will be the fact that it pays to be a rapid reader and that one may improve his reading rate if he works steadily to do so. In olden times people believed that slow readers got the thought better, and remembered it longer, but experiments have proved that more rapid readers than slow readers get the thought well.

How can one go to work to increase his speed? Mr. Edison found at one time that he was a slower reader than some other men were. He said that he could not afford that, so he trained himself to read rapidly. Concentration of mind on what one is reading is of first importance. Whatever improves one's knowledge of the thought also increases his speed. Quick clear recognition of words also helps greatly. The eye sees several words at a time. With practice you can learn to read words in groups instead of reading word by word; indeed you undoubtedly do this in some measure already. One profitable exercise is to divide sentences or paragraphs into word groups in this way:

"While he was watching / the tumbling water / and wondering / where it all came from / and where it was going / he thought he saw / swiftly moving shadows / flitting / from the water below / up and into the mill pond above."

Another exercise is to work rapidly through a paragraph, underlining the word groups which are very familiar. In this way the eye is trained to look for larger groups than the single word. When a word is hard the eye may have to look at it several times before it is recognized. Speed comes with ability to read in larger units.

Just as you can measure your height and weight and learn how you compare with other boys and girls of your age physically, so your parents or teacher may measure your reading ability. By using the "Thorndike scale Alpha," your vocabulary may be measured; the "Gray tests" will measure both speed and understanding of oral reading; and the "Kansas tests" will measure rate and comprehension in silent reading. All these tests are described in the 18th yearbook of the National Society for the Study of Education, Part 2. The sooner you know where you stand according to these measurements, the surer you will be that you are working intelligently to improve your reading abilities.

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

READING

ONE of the splendid things John Ruskin said was in the book he wrote for a young girl, whom he asked a question which meant this: " Will you stand gossiping with foolish people when you can talk with Shakespeare?"

It is one of the things we can never be thankful enough for, that we can sit down with Shakespeare. Have you ever thought that Alfred the Great or William the Conqueror *never read a printed book?* The growth of books is a story as wonderful as any that a book has ever told. It must have seemed a marvelous thing in the Long Ago that a man should make marks on stone, and then on the bark of trees, and then on paper, and send his thoughts in such a way to his far-off friends; and then, when the first real printed book came into the world, it must have seemed to the men of that time as if a new wonder had fallen from the sky.

And if the first book had really fallen from the sky, straight out of the hands of angels, it could not have brought into the world a more wonderful seed than it did contain; for out of that book has come not only a marvelous story but the whole spreading of knowledge among mankind, the setting free of slaves, the scattering of darkness, the discovery of millions of worlds, the love of justice, the laws of health, and the whole mighty structure of civilization which has sprung up about the boy born in the days of books.

The calm joys of good reading are depicted in this painting, 'Serena', by the famous artist, George Romney.

Never throw a good book on the floor; never handle it lightly without thinking. There is something in it that will live forever; something that will live in the world when the forest from which the paper was made is covered with great cities. That book, perhaps, has in it the thought of a man whom this world knows no more; it may carry on his thought to a boy who will come into the world when the age we live in is as far back as the age of ancient Greece and Rome. We should treat good books with reverence.

And so we should reverence the power of reading them. Nothing will bring you more lasting pleasure if you use it well. When nothing that money can buy will bring you peace, the power of reading may heal your sorrows. When all others fail, a book will be your friend, and reading will bring you the friendship and help of the kings among men.

There are two things we should remember about reading; two reasons why we read at all. The first reason is to gain knowledge; the second is to stir the imagination. They are noble reasons, both of them; for without knowledge nothing worth doing can be done anywhere, and without imagination there is no hope for the future of mankind. And I think I may well say to you that in choosing your books you may safely put aside any book that does neither of these two things. It is a safe rule that a book that gives you nothing takes something from you.

Read the books that become a part of you, holding you as you read them. Healthy excitement is good for us all. We all love thrilling books, tales of mystery that stir us through and through, lifting us up beyond ourselves, out of our little lives, into the world that lies far off beyond our reach, yet not beyond our dreams when we are borne on the wings of imagination.

Getting at the Heart of Things

When we read, it is good that our imagination should run wild. It is more important that we should read a book which carries us up into the clouds, or down into the seas, than one which merely tells us that Henry the Eighth of England had six wives, that the Duke of Marlborough won the battle of Blenheim, that De Soto first discovered the Mississippi River. It is right that we should want to be accurate, to have facts at our finger ends, as we say, to want to answer questions or turn up references quickly; but it is vastly more important that we should know what William Harvey did for mankind when he discovered the circulation of the blood than that we should know the date on which Harvey was born. Most of us give far too much time to details, to merely cramming our minds with lifeless facts instead of learning their meaning. If we try to get into our mind the meaning of this or that, we can look up the little details when we want them. We may know all the dates of history and be uneducated; they are educated who, though their minds are not crammed with names and dates, have hold of the truth of things, of the law of cause and effect, of the things that lie behind, of the growth of the meaning of the world about us, of their place in it and their power in it, of the way they came and the way they go; and all these things we may read in books.

Therefore we should read whatever thrills us with wonder of a noble kind; it is good that we should be stirred like that. But, love the spirit of adventure as we may, the wise reader in this great age of the world will seek his interest in the great realities of the world; in those true stories of our age which are more wonderful and thrilling than all the books of other days. The truth of our own day is stranger than all the fiction of the past.

Realities Greater than Dreams

The world is full of many kinds of people, but there are two kinds of people in the world whose adventures make up stories every day as thrilling as 'Robinson Crusoe'. There are the men who are working in material things—making engines, or motor cars, or flying machines. Will they ever take us to Europe in a day with the regularity of our steamships and trains? Will they ever fly to another world, and really see if there are men on Mars? And then there are the men who work in things that are not seen—the great kings of science who peer into the invisible, who weigh the earth and measure the stars, and ponder over the mystery of Life itself until they seem to be almost solving it; and then the secret slips away, and men still ask where Life came from, and where it goes, and what it means. Will they find it out one day? The little crystal that the chemist makes—will it one day come alive? Will these men give us longer lives, kill all disease, or drive back death?

A wonderful and solemn thing it is to think of these two groups of men, one building up a mighty plan of material things, engines and wheels and wires that seem to encompass all mankind; the other peering behind it all, ever finding something new—until the day may come when the quiet man will bid the others cease, and the great material things, the engines and wheels and wires, may be no more wanted, because we shall travel without engines and get power without wheels and speak without wires. Are these things as interesting as pirates? Are these men fit to be your heroes? Are these mysteries less exciting because the kings of the earth are trying day and night to solve them?

It is only the true book that lives, the book that is true to life, as any made-up tale may be; and we should not waste our time on tales that have no sort of truth in them at all. Have nothing to do with books that play with truth; books of what we call satire, a sort of twisting of the truth; or books of what we call cynicism, which are the worst of all, for the cynic is a man whom nothing pleases, because his mind is grown old before his body, and his soul is sour.

Choosing Your Book Friends

A good book, said Milton, is "the precious life-blood of a master-spirit, embalmed and treasured up on purpose to a life beyond life."

Choose your books wisely, as you choose your friends; and you will find in the world no more enduring friends than books. Never be far away from them. In the train, in the field, wherever you are, you may have them with you; at home or abroad they will follow you, the most comforting helpers of men. You will find one, if you seek it, on almost any subject in the world; in hope or in perplexity you may seek a friend in books, and at the door of these friends you need never knock in vain. They will tell you all that wise men know; they will admit you to the company of the noblest men and women who have ever lived. The love of books is the pass to the realms of gold that are nearer to the Kingdom of Heaven than anything else on earth. In poetry, in the Bible, in the great books that will never die, a man may reach his heart's desire.

READING (*rĕd'ing*), **PA.** A rich and beautiful farming country surrounds this city of southeastern Pennsylvania, while its excellent transportation facilities and proximity to the coal region make it an important manufacturing center. Neversink Mountain looks down on it from the southeast, and Mount Penn from the east, while the Schuylkill flows past on the west. Iron and steel products constitute Reading's chief output, but it depends on no one industry. It is the second city in the United States for building hardware and for hosiery. Its tube works, the largest in the country next to those of the United States Steel Corporation, are capable of producing 125,000 tons of tubular goods a year. It has, too, the shops and yards of the Philadelphia and Reading Railroad. More than 750 manufacturing plants make more than 100 different products here, ranging from art glass to adding machines, and from hats to steel frames for automobiles. Reading was founded in 1748 by Thomas and Richard Penn, sons of William Penn. Population, about 110,000.

REAPING MACHINES. The cradle scythe and the ancient sickle or reaping hook in various forms were the only means of reaping grain until the early 19th century. Of the various machines devised between 1820 and 1860, McCormick's "American reaper," invented in 1831 (*see* McCormick, Cyrus H.), alone has survived, and its click around the world has become "the music of an international anthem." It has been called a "barometer of civilization," because it can be used only by intelligent free labor.

Later machines carried the cut grain up to men riding on a side platform, who bound the grain by hand and dropped the sheaves on the ground. Then came the self-binders, which whip a twine around a bundle of grain as soon as it is cut and drop the finished sheaves. A late attachment ties seven to eleven sheaves in a shock, and sets it on end.

Even more wonderful is the combined harvester and thresher which cuts, cleans, and threshes the grain, dropping the sacked grain into wagons for hauling off the field. Such machines are drawn by huge tractors and are used on the western grain fields of the United States and in Australia. A machine called a stripper or "header" simply cuts off the heads of the grain, leaving the straw standing. Special machines have also been adapted for cutting corn and rice and for harvesting other crops.

The BANNER *of* MERCY *on the* FIELDS *of* SUFFERING

Origin of the Red Cross Societies and Their Noble Work—The Symbol of Help and Comfort in Flood, Fire, Pestilence, and War

RED CROSS SOCIETIES. It was the end of a hot stifling day in June, in the year 1859, at the close of the terrible battle of Solferino. Napoleon III of France, who had led the allied French and Sardinian armies to free northern Italy from the yoke of Austrian supremacy, had won the victory. But such a victory! The carnage made even the victorious Napoleon III welcome peace. Fifteen thousand dead and wounded lay on the field of battle; days passed before the few surgeons could attend to all the wounded, and many perished before help reached them.

At this time a young Swiss, Henri Dunant, happened to be traveling through the battle area, and his heart was rent by the agonizing cries of the wounded. As best he could, he bathed and dressed their wounds, brought water to those burning with fever, and cheered and comforted the sufferers. He gathered a number of women in the nearby Italian city into a band of volunteer nurses, who, following his example, ministered to friend and foe alike, repeating *Tutti fratelli* (All are brothers) as they cared for French, Austrians, and Italians, friend or foe, without distinction.

Henri Dunant never forgot the terrible scenes he had witnessed. He wrote a pamphlet describing them so vividly that his appeal moved the hearts of all who read it. He showed how much of this suffering and death could be avoided by an organization to protect and care for the wounded in war, "without distinction of nationality."

His plea finally resulted in an international conference at Geneva in 1864, at which 14 nations adopted a treaty, known as the "Red Cross Treaty." This was revised in 1906 at the Hague. It provides for the protection in time of war of relief societies to be organized in the various nations. As a compliment to Switzerland, the Swiss flag with its colors reversed—a red cross on a white ground—was adopted as the emblem of "neutrality and humanity."

THE RED CROSS IN THE WORLD WAR

During the World War the Red Cross performed invaluable service near the front lines, particularly in assisting the overtaxed Army Medical Corps. This shows a dressing station maintained with the assistance of the Red Cross near St. Gilles, France, during the Marne-Aisne advance in the summer of 1918.

During the Crimean War, ten years before the Geneva Conference, Florence Nightingale had gone forth to care for the wounded soldiers of England and had shown the world how much could be accomplished when love and sympathy are combined with practical wisdom and skill. During the American Civil War a Sanitary Commission had rendered immeasurable services in preventing disease and relieving suffering. Representatives of this commission told the Geneva Conference how volunteer aid might be efficiently organized. Now, under the Red Cross, this same spirit of practical helpfulness is made international; the hearts of all nations are united in the service of humanity when suffering comes from flood, fire, pestilence, and war. In every war that has since been waged, this banner of mercy has floated amidst the strife, a symbol of healing and comfort usually respected by friend and foe alike.

The most urgent call it had ever received came to the Red Cross at the time of the World War of 1914–18. True to the principle of preparing for the needs of war in time of peace, Red Cross societies in the belligerent and neutral countries were ready to send corps of nurses, ambulances, and hospital equipment into the fighting districts. Never before had the world seen so terrible a conflict, but never before had such a determined and effective effort been made to bring whatever comfort was possible to the fighting and suffering men.

In the United States the Red Cross was reorganized to meet the extraordinary emergency. A War Council of seven members, appointed by President Wilson, as president of the American Red Cross, was made the chief governing body and given sole authority to expend the special fund raised for war relief by voluntary contributions of the people. More than $100,000,000 was raised the first year, and by the end of the war the contributions of money and material had amounted to about four times this sum. Departments were established for the carrying on of special activities. The Department of Military Relief not only looked after the distribution of hospital equipment and supplies of all kinds, but provided rest stations, or "joy stations," as some of the soldiers called them, to give rest and refreshment to the weary men on their way to or from the fighting line, and sent portable canteens with hot drinks in winter and cold in summer into the very trenches. The Nursing Service equipped and sent thousands of trained nurses to care for the wounded, and through their aid millions of lives were saved. Nor were the families of the soldiers forgotten. Their welfare was looked after by the Home Service of the Department of Civilian Relief, which sought through friendly counsel and neighborly assistance, and where necessary, through financial aid, to save the relatives of enlisted men all possible trouble and anxiety. A Bureau of Communication instituted search for men not heard from, and gathered information concerning men who were ill or wounded or who had died. The Bureau of Prisoners' Relief maintained correspondence with the families and friends of every American prisoner on record, as well as sending food, clothing, and other comforts to the prisoners themselves.

Membership in the American Red Cross, which is open to any citizen or resident of the United States, reached 22,000,000 before the close of the war. There were more than 3,000 chapters, with about 15,000 branches, and a great many auxiliaries. These chapters, branches, and auxiliaries represented the great producing force of the Red Cross during the war. They carried on the task of knitting sweaters and socks for the soldiers, sewing clothing for the refugees, and rolling bandages and making surgical dressings for the wounded.

Among the school children of America a Junior Red Cross was organized and soon had a membership of 8,000,000. The Juniors knitted and sewed like the older members, and made a special effort to help the children in other lands. A fund was established for the care of mutilated children in the war-ravaged countries, for scholarships and vacations, recreation centers, day nurseries, and milk stations. Many were the means adopted of bringing about the aim of a "happy childhood the world over." Some groups of chapters made toys while others prepared scrap books to show the children in distant lands what the

THE AMERICAN RED CROSS AT WORK

Not only did the American Red Cross work at home and abroad among the soldiers and sailors, but it found many tasks confronting it in dealing with the civilian populations of France and Belgium. This page shows only a few of the war-time activities of the "A. R. C.," as it was familiarly known. 1. Happy French children in a ward of the Red Cross civilian hospital at Neufchâteau. 2. An American worker, a member of the Home Communication Service, writing a letter for a wounded soldier. 3. Women at the Washington (D.C.) headquarters making up comfort kits to be sent to France. 4. An instructor at the Red Cross Institute for Crippled and Disabled Men, New York City, showing pupils how to operate a monotype casting machine. 5. French women and children, convalescing in the garden of a Red Cross hospital near Paris. 6. An American doctor giving a demonstration at a child welfare exhibition. In the corner, back of the partition, a dentist is at work. 7. Food for fighters is being provided at a canteen.

customs and industries of America were like. Thus a bond of fellowship was established among the children of the world. The work was not confined to foreign lands, nor did it end with the war. It has gone hand in hand with the movement for Americanization and good citizenship, and thrift campaigns and health crusades have been an important part of the program.

The coming of peace left much work for the Red Cross, for there were many problems remaining to be solved and much suffering still to be relieved. Many calls continued to come from abroad, and the burdens at home grew greater with the return of sick and disabled veterans.

The Red Cross is not, as many suppose, an international society. Each of the 43 national organizations is independent, but there is an International Committee at Geneva through which communications are made among the various societies, and representatives of the national societies meet in international conference every five years.

The American National Red Cross was organized in 1881 under the leadership of Miss Clara Barton, who became the first president (*see* Barton, Clara). It was reincorporated in 1905 under the supervision of the United States government. From the time of its first organization an important part of the work of the American Red Cross has been the relief afforded after great disasters—the Johnstown flood (1889), the Galveston flood (1900), the San Francisco earthquake (1906), the Omaha tornado, and the Ohio floods (1913), and many other calamities, such as epidemics, storms, shipwrecks, fires, famines, and mine disasters.

Because of the objection to the use of the cross in Mohammedan Turkey, the organization of that country was permitted to substitute the crescent and is known as the Red Crescent Society.

RED RIVER OF THE NORTH. Although the Red River of the North (so called to distinguish it from the Red River of Louisiana) is only about 700 miles long, several circumstances have united to make it one of the important rivers of North America. It has its source among the lakes in the west-central part of Minnesota, only a few miles from the source of the Mississippi. Flowing northward, it forms the boundary between Minnesota and North Dakota, then enters the Canadian province of Manitoba, and empties into Lake Winnipeg, which finds its outlet into Hudson Bay. One of the upper branches of the Red River issues from Lake Traverse, which at high water connects with the Mississippi so that it is possible to journey by water from Hudson Bay clear to the Gulf of Mexico.

The Red River valley is one of the world's most famous wheat-growing regions, because of the fertile soil deposited ages ago by the glacial ice sheet and by the enormous body of water (Lake Agassiz) which in prehistoric times covered a vast territory in this region. In many parts of its course the Red River and its tributaries have cut narrow channels through this soil with steep sides 20 to 50 feet high.

In the Red River valley occurred one of the tragic episodes of Canadian history, the Red River rebellion of 1869. In that year the half-breeds or *metis*, who had settled to the number of about 10,000 in the Red River valley, rose in rebellion against the Canadian government, which had just acquired this region with the rest of the immense possessions of the Hudson's Bay Company. A provisional government was established by the rebels at Fort Garry (now Winnipeg), headed by Louis Riel. A force under Sir Garnet (later Lord) Wolseley crushed the rebellion the following year, and Riel fled to the United States. Following a subsequent rising in 1885, in which Riel played a leading part, he was tried and convicted of treason and hanged.

RED SEA. Travelers from Europe through the Suez Canal to India or other countries on the opposite side of the globe usually find the Red Sea the most uncomfortable part of their voyage. For this little basin, only 1,200 miles long from the Isthmus of Suez to the Strait of Bab-el-Mandeb, and from 100 to 250 miles wide (except at the Strait, where it narrows to 15 or 20 miles), is so hemmed in that the air above is always saturated with moisture, and a tropical sun beating down from cloudless skies makes the air hot as well as humid. On the east lies Arabia, a narrow sandy strip of coast backed by a limestone range, and on the west lies Africa, with the wide sandy plains of Egypt to the north, rising into the high table-land of Nubia and the mountains of Abyssinia farther south. Navigation from shore to shore consists chiefly of crowded boatloads of pilgrims bound for Jedda, the port of Mecca at the time of the Mohammedan Hadj, and an occasional cargo of grain from Egypt. Up and down, however, between Europe and the East Indies, the Red Sea has been from early times a great highway for the trading peoples of Mediterranean lands—Egyptians, Phoenicians, and Arabs, and in the Middle Ages, the Venetians. After Vasco da Gama's discovery of the route around the Cape of Good Hope, in 1498, most traffic went that way for the next 370 years. With the opening of the Suez Canal, in 1869, the Red Sea regained its prestige (*see* Suez Canal).

The Red Sea occupies a long trench or valley caused by the subsiding of the earth's crust. It is fairly deep (except in the Gulf of Suez) averaging about 1,500 feet. The Sinai peninsula lies at the northern end, between the narrow Suez Gulf and the Gulf of Akabah. It is at the northern end of the Gulf of Suez that the children of Israel are believed to have made their miraculous crossing.

Both shores of the Red Sea are lined with coral reefs and coral islands, and the pilot's chief danger lies in these hidden reefs upon which the sea never breaks owing to their porous formation. The Red Sea is also subject to sudden squalls, making sailing navigation difficult.

The GREAT DRAMA *of the* REFORMATION

The Most Stupendous Revolution in the Religious History of the World—The Men and Measures that Figured in It—Origin of the Name "Protestant"—The Catholic Counter-Reformation

REFORMATION, PROTESTANT. How stupendous were the changes wrought, how manifold the causes, and how memorable the figures in the crowded scene of this great drama of the 16th century—the Protestant Reformation—which stands at the threshold of modern history!

At the center of the movement we behold Luther, the Saxon monk with flashing eyes, arch-heretic or prince of reformers, according to one's point of view. His Renaissance forerunners stand near by—the scholarly Erasmus who, largely through his printed editions of the Greek New Testament and the church fathers, stimulated research into the organization and teachings of the early church; and Reuchlin, who first led Christian men to the study of Hebrew, and whose scholastic enemies are parodied in the excruciatingly funny 'Letters of the Obscure Men' (*Epistolae Obscurorum Virorum*). In the background we dimly see the spiritual mystics of the later Middle Ages—Tauler of Strasbourg, the "Friends of God," and the "Brethren of the Common Life"—whose teachings of "heart religion" came to Luther in part through his monastic superior Staupitz, and helped to lead him to his doctrine of "justification by faith." By Luther's side we behold the large head and insignificant body of Melanchthon, his colleague in the University of Wittenberg, who becomes the chief theologian of the German Reformation and "Schoolmaster of the German nation."

Many Other Great Figures

About these central figures are grouped Ulrich von Hutten, the humanist knight, afire with German patriotism; Tetzel, the indulgence preacher, who caused the outburst and whom the church soon disowned; the Emperor Charles V, burdened from boyhood with the cares of many kingdoms, desirous of an orderly church reform but resolved that Luther shall "never make a heretic of him," and distracted from the suppression of the German revolt by wars with France over Italy and his fluctuating negotiations with the pope. In outlying parts of the picture we see the contemporary reformers of other lands—Le Fèvre of France and Zwingli of Switzerland, who arrived independently by way of humanism at similar views as Luther concerning indulgences and justification by faith; John Colet, who worked in England for Catholic reform such as was desired by Erasmus and Charles V; John Calvin, who made Geneva the world center of Puritanism; and Loyola, soldier and monk, whose "Society of Jesus" (Jesuits) became the chief agency of the Catholic Reformation in stopping the further progress of Protestantism. Surely no period in history is richer in striking figures and memorable scenes than this of the German Reformation!

The causes of the movement in Germany included a growing dissatisfaction at recognized abuses in the church; the broadening of men's minds through the revival of learning and the discovery of the New World (*see* Renaissance); and a deep-seated feeling of social and economic discontent, which broke out in 1525 in a widespread Peasants' Revolt against their masters, put down with bloody cruelty by the German princes urged on by Luther. The growing national spirit of Germany added a political element which deeply resented the sums of money drawn off each year to Rome through various papal fees and taxes.

The Rally around Luther

All these forces of discontent with the old order rallied around Luther in the early years after 1517 and gave him their support. Princes, German patriots, church reformers, men of the new learning, knights, and peasants each thought he was their especial leader. Gradually they saw that this monk was not the voice of any special interest or group, and many drifted away into indifference or opposition by 1525; but by that time the movement had passed beyond control, even beyond the control of Luther. His denunciation in 1517 of the abuses of indulgences had resulted in a political, economic, social, and religious revolt which could not easily be suppressed.

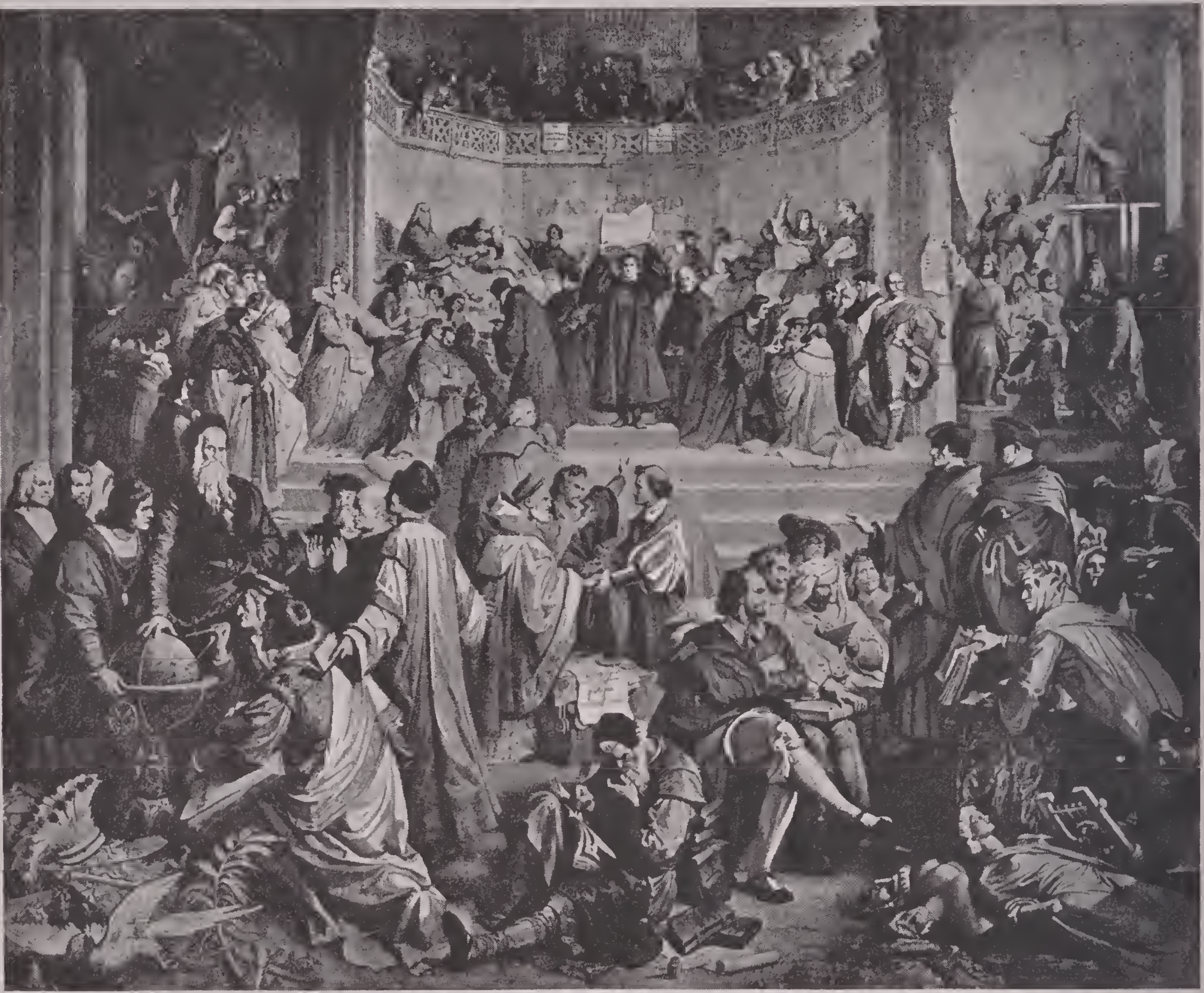
Luther's opinions developed rapidly in the months of controversy. He rejected the headship of the pope, and—like Wyclif and Huss before him—set up the Bible as the sole source of Christian truth. He denied that priests have any power that laymen do not possess; and declared that the vows taken by monks and nuns were not binding and that monasteries should be abolished. He rejected the celibacy of the clergy and all but two of the seven sacraments—the Lord's Supper (Eucharist) and baptism—and profoundly modified at the same time the teaching concerning the Eucharist.

By 1521 he was definitely a rebel against the pope and the church. Only the fact that Germany was not a strong centralized monarchy but a loose federation of states, and that the head of Luther's own state—the Elector Frederick of Saxony—insisted on fair play for this Saxon university professor, prevented the Lutherans being crushed in the beginning by the combined powers of pope and emperor.

Landmarks in the Reformation

The chief landmarks of the Reformation, so far as relates to Germany, were these: Luther's posting of his Ninety-five Theses against indulgences (1517); his burning of the pope's bull and the books of the canon law (1520); his appearance and condemnation at the Diet of Worms (1521); the Peasants' Revolt,

THE AGE OF THE REFORMATION AND THE RENAISSANCE



On this crowded canvas the artist, Wilhelm von Kaulbach, has brought together the chief actors in the great drama of the New Age, many of whom never met in actual life. On the platform at the rear Luther holds aloft the Bible, while around him cluster other theologians of the period. Against the two pillars to the right and left stand the two great monarchs who championed the Protestant cause, Gustavus Adolphus of Sweden and Elizabeth of England. In the right alcove Gutenberg, with Renaissance artists at his side, holds up a printed sheet. In the left alcove Copernicus, Galileo, and others expound the new astronomy. In the left foreground, geographers and discoverers hover over the globe to which Columbus has recently given a New Continent. Hans Sachs, the shoemaker poet, sits in the center of the foreground. In the distance back of him is a group clasping hands over the Religious Peace of Augsburg. A little nearer and to the right sits Shakespeare listening to laurel-crowned Petrarch; back of them are Erasmus and Reuchlin. In the right corner are fragments of Greek and Roman art which the Renaissance had taught men to venerate.

which the nobles, urged on by Luther, put down with great cruelty (1525); the Diet of Spires (1529) which decreed that religious changes should cease and the rights of the Catholic church be restored; the protest against this decree (whence comes our term "Protestant") signed by the Lutheran minority in the diet; the five wars (1521 to 1556) waged with France by Charles V over Italy, his hostile relations at times with the pope, and the advance of the Turks (Mohammedans) to Germany's doors through the conquest of Hungary (1526)—all of which hindered the emperor's free dealing with the Lutherans; the adoption of the 'Augsburg Confession' setting forth the Lutheran faith (1530); the Schmalkaldic War (1546–47), in which the Protestant forces were defeated by those of the emperor, largely through the defection of Maurice of Saxony, one of their number; the religious Peace of Augsburg (1555), in which the emperor was at last forced to grant to the ruler of each German state the right to choose between Catholicism and Lutheranism. For more than a half-century this treaty gave to Germany religious peace. (*See* Thirty Years' War.)

The Lutheran faith established itself chiefly in northern Germany and Scandinavia. The Swiss, French, and Dutch movements drew their direct inspiration from a similar movement launched by John Calvin a generation later—a movement which inspired Scotland through John Knox (*see* Calvin; Knox). The English Reformation began when Henry VIII broke with the pope in 1534 (*see* Henry, Kings of England); but the introduction of Protestant doctrine in the Anglican church did not come until the reign of Edward VI.

At the beginning of the Reformation the authorities of the Roman church did not realize the extent of the danger which threatened it, for they regarded the movement as merely one of the many discussions and schisms to which the church had always been more or less subject. When they saw the revolt spreading into country after country, and taking so firm a hold on the minds both of rulers and people, their eyes were opened and they proceeded with zeal and energy to repair the breaches that had been made. The Society of Jesus, founded by Ignatius Loyola in 1540, supplied an army of enthusiasts whose policy and devotion proved invaluable. By the decrees of the Council of Trent (1547–63) the church corrected many of the abuses complained of and reaffirmed its ancient doctrines and traditions. A succession of able popes during the latter half of the 16th century then followed the policy marked out for them by this Counter-Reformation, and thus removed the incentive to revolt in lands that were still loyal.

To quote the language of Lord Macaulay: "Two reformations were pushed on at once with equal energy and effect—a reformation of doctrine in the north and a reformation of manners and discipline in the south. In the Order of Jesus was concentrated the quintessence of the Catholic spirit; and the history of the Order of Jesus is the history of the great Catholic reaction."

Thus the middle of the 16th century saw the tide of the revolution checked. By the close of that century Europe was divided between the two forms of Christianity by almost the same lines as exist at the present day. To quote again from Macaulay: "As Protestantism had driven Catholicism to the Alps and Pyrenees, so Catholicism rallied and drove back Protestantism, even to the German Ocean; nor has Protestantism in the course of 200 years been able to reconquer any portion of what was then lost."

For additional information *see* the related articles: Charles V; Loyola; Luther; Wyclif; Zwingli.

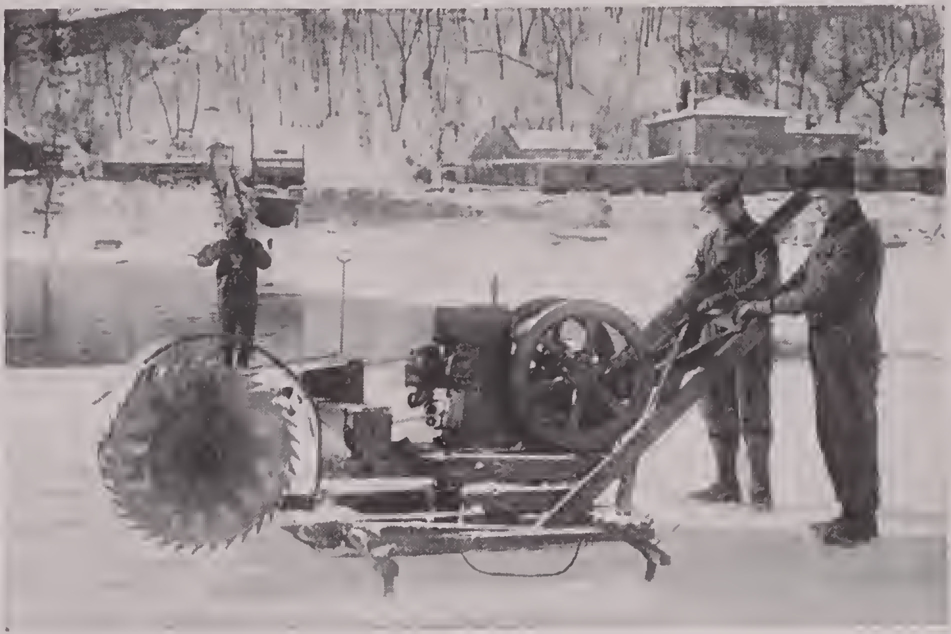
The Interior of a Modern Refrigerating Plant, Showing the Machines which Produce Artificial Cold

REFRIGERATION. Artificial cold, or refrigeration, is almost as important as fuel in our complex modern life. Not only does it supply us with refreshing cold foods and drinks in summer, cool our theaters and other large public buildings, and preserve our foods in the home, in warehouses, and in transportation (not to speak of keeping our furs free from moths in summer storage); it is actually a necessity of life in cities, especially for babies, who sicken and die without the fresh milk which usually can be preserved during summer only by ice or some other means of refrigeration.

The first house for storing ice was built in 1805. From 1860 to 1870 people began to know the advantages of refrigeration, and many ice houses and cold storage plants were built, using natural ice. Then came the invention of the refrigerator car for shipping perishable food. The first of these cars ran from

Chicago to New York in 1867 with a load of beef. From that time on, enormous quantities of meats, fruits, and vegetables were shipped, and nowadays railways and packing companies maintain large "fleets" of refrigerator cars. Ships also are equipped to carry great quantities of meats in cold storage to other lands, thus saving the expense of shipping live animals. In the World War the soldiers in France were supplied with food in this way, while during the past 30 years or more frozen mutton has been shipped from New Zealand to England in constantly growing quantities.

HARVESTING A CROP OF COLDNESS



In just a second, the saw, now raised while the machine is being shifted, will sink its teeth again into the ice and begin to bite out blocks to keep next summer's milk cool.

The cold storage plants in the smaller cities and towns may still use natural ice, but mechanical refrigeration, or the production of cold without ice, has been generally used since about 1890. It gives lower temperatures, permits the regulation of the temperature as desired, and in many cases is cheaper than natural ice. Mechanical refrigeration has also come into use for cooling buildings and refrigerators, and also for making ice artificially.

Modern cold storage plants are huge buildings with special machinery for regulating temperatures so that each class of food will be kept at its best. These plants are so built and of such materials as to keep out the heat and retain the cold. The air within is kept moving by fans, just as it is in refrigerator cars, so that the cold air is carried to every corner. In rooms used for keeping fruits and other foods, ventilation is provided, while in other rooms the air is kept pure and dry by the use of absorbing chemicals, such as lime or calcium chloride. When we remember that eggs are spoiled by freezing, while it does no harm to freeze fish, the necessity for carefully regulating the temperatures of the low ceilinged rooms will be understood. Large recording thermometers with pencils which move over dials as large as the face of a clock are sometimes used to keep hourly records of the temperature.

The Principles of Refrigeration

Cold can be artificially produced by the liquefaction of a solid, by the vaporization of a liquid, or by the expansion of a gas; as we know, the liquefying solid, the evaporating liquid, and the expanding gas all cool their surroundings by absorbing heat from them (*see* Evaporation; Freezing). All three principles have been employed in artificial refrigeration and artificial ice making. It is the liquefaction of the solid ice that cools the food in the ice box and freezes the ice cream in the freezer. The most widely used systems of iceless refrigeration—the "compression system" and the "absorption system"—depend on the evaporation principle, and so does the "vacuum system." The "compressed air system" is based on the cooling effect of expanding gas. All these systems are used for cooling buildings, refrigerators, etc.; the compression, the absorption, and the vacuum systems are also used for the commercial manufacture of artificial ice.

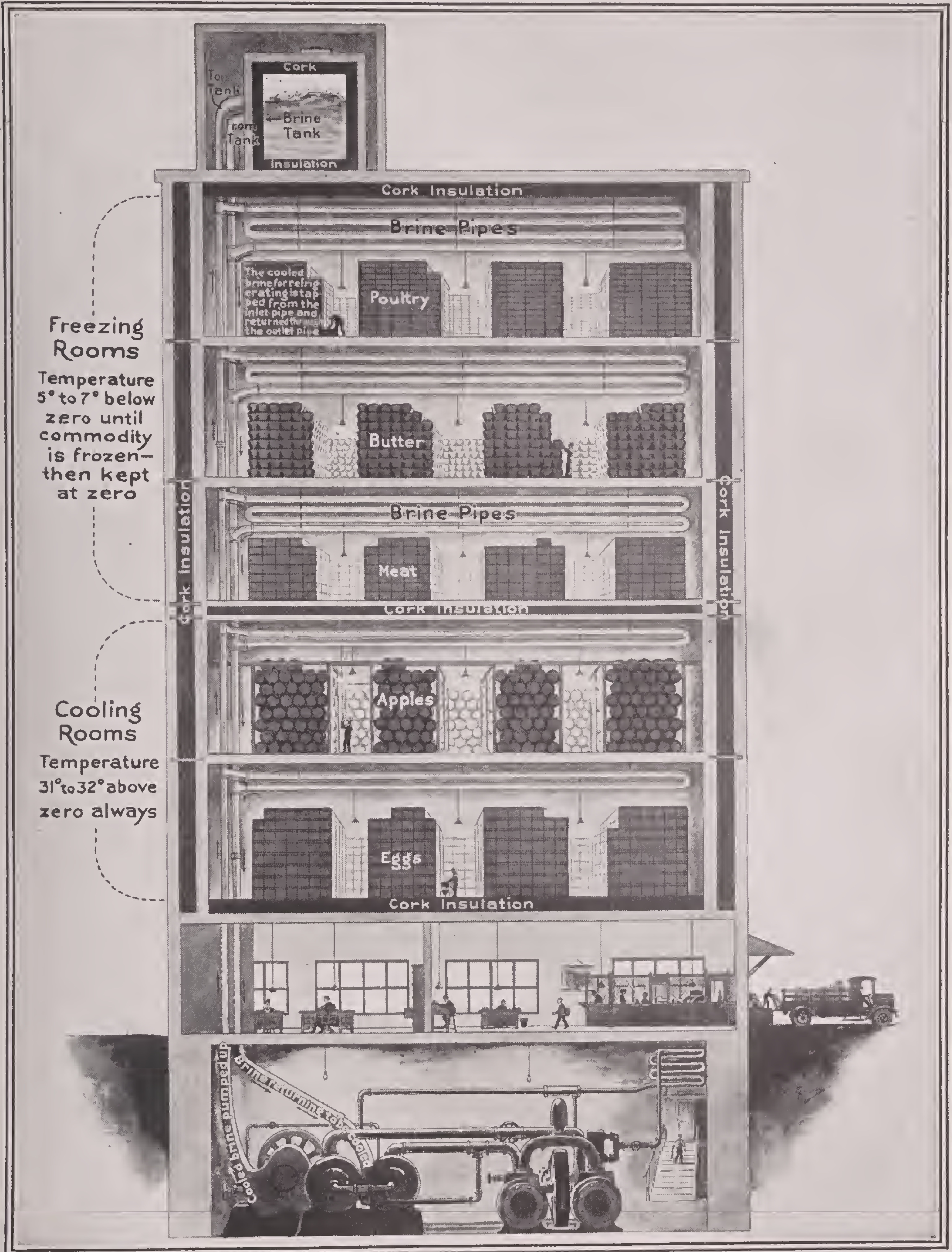
Of the gases used to produce cold by rapid evaporation after compression into liquid, the most widely used is ammonia vapor. In the "ammonia-compression system," anhydrous or waterless ammonia after compresssion by machinery is released through needle sprays into parallel rows of pipes running through a brine tank, in which stand rectangular cans of distilled water covered with boards. Presently the brine becomes very cold, but does not freeze. The water in the cans does freeze, and thus makes artificial ice.

Many cans can be frozen at once. When frozen, they are lifted out by a crane and dipped in another tank of boiling water, to melt the cakes just enough to let them drop out. This is the "can system" of artificial ice-making. In the "plate system," the coils cool flat plates on the side of a reservoir, in which the ice forms.

After the ammonia gas has passed through the pipes in the brine tank, it is cooled with running water (for it has produced cold by absorbing the heat from its surroundings in the process of becoming a vapor), and is returned to the compressors for use over and over again. Other vapor compression systems use carbon dioxide or other gases.

In the "absorption system" also, cold is produced by the rapid evaporation of a volatile liquid, but the vapor is recovered by absorption into a liquid from which it can be separated by heat instead of by direct condensation. Here again ammonia is generally employed (the "ammonia absorption system"), but it begins the cycle as strong *aqua ammoniae*, the solution of ammonia in water. Ammonia vaporizes

WHERE "NORTH POLE" ATMOSPHERE PRESERVES FOOD


Cork
To Tank
From Tank
←Brine Tank
Insulation
Cork Insulation
Brine Pipes
The cooled brine for refrigerating is tapped from the inlet pipe and returned through the outlet pipe
Poultry
Freezing Rooms
Temperature 5° to 7° below zero until commodity is frozen—then kept at zero
Butter
Brine Pipes
Cork Insulation
Meat
Cork Insulation
Cork Insulation
Apples
Cooling Rooms
Temperature 31° to 32° above zero always
Eggs
Cork Insulation
Cooled brine pumped up
Brine returning to be cooled

This shows how the interior of a great cold-storage warehouse is arranged. In the basement is the refrigerating machinery, which maintains a circulation of chilled brine throughout the storage floors. On the first floor we see the offices; then come the cooling rooms, where foodstuffs that would be injured by too much cold are kept. Higher up are the freezing rooms, where, by providing more brine pipes to the room, an intense cold is maintained. The building is lined with insulating material in order to keep out heat from the surrounding air.

at a lower temperature than water, so when the solution is heated the ammonia is driven off, to be condensed, compressed, and follow the same course as in the compression system, until finally, instead of being recondensed, it is passed over and absorbed by weak ammonia water, making the original strong ammonia solution.

In the "vacuum ice-making machines," water is cooled into ice by its own evaporation, speeded up in a vacuum. In some machines the vacuum is produced entirely by mechanical means; in others strong sulphuric acid is used to absorb the water vapor, in addition to an air pump.

"Compressed air machines" are used to some extent for cooling and ventilating in places where vapors would be dangerous, as on war vessels. Iceless refrigerating and ice-making machines for household use are now on the market; in these a constant temperature of 38° to 44° F. is maintained by thermostat control.

In several cities companies have been formed for piping "cold" through street mains in the same way that gas, water, and heat are already supplied. Artificial ice-skating rinks are maintained even in summer in some cities and artificial refrigeration plays its part also in such varied industries as chemical works, sugar factories, steel tempering plants, dynamite factories, and India rubber works.

Although artificial ice-making has become a great industry, large quantities of natural ice are still used, and collecting and selling natural ice is still an important industry. Perhaps you have seen large ice-houses built near lakes and streams where the winters are cold enough to produce thick clear ice.

In the Ice Harvest Field

The natural ice crop is harvested as follows: First, the surface is scraped with a scraper to remove snow and débris much as earth is removed with a scraper in road making. Then an ice harvesting implement with knives at the bottom is run across the surface to cut parallel grooves. Following this, drawn by horses or tractors, comes the heavily weighted ice cutter, with longer knives which cut nearly through. Men with hand saws complete the cutting, after which the cakes are floated down runways to the ice house. Most ice houses have elevators which run like moving stairways, and the cakes are pushed onto the endless chains of these stairways. When they reach the top, it is an easy matter to slide them along the floors, drop them where they are wanted, and cover them with sawdust to prevent melting. Later in the year this ice is taken out as needed and shipped on clumsy barges or old box cars to the cities and towns. (*See* Cold Storage; Meat Packing.)

REGINA (*rĕ-ġī′nȧ*), SASKATCHEWAN. A glance at a map of Saskatchewan showing the spider-web of railways that radiate from Regina will make clear why this city is the commercial as well as the political capital of the province. From Regina go out every year millions of dollars' worth of hardware, groceries, clothing, and agricultural implements, to supply the fast-growing farm population of this great young province. Most of these supplies come from the eastern industrial centers and from the United States, but the city is fast becoming a manufacturing as well as a distributing center. Grain elevators, flour mills, wood-working establishments, foundries, machine shops, and an oil refinery are among the many industrial plants. The factories and wholesale houses are concentrated in a district a mile long and half a mile deep reserved for such establishments. All this district was originally owned by the city, and is sold or leased to industrial enterprises. The city also owns the spur railroad tracks which run to the various plants. Like many other cities of the Canadian Northwest, Regina is a firm believer in municipal ownership, owning its street railway, light and power plant, waterworks, and stockyards. Besides the splendid $2,000,000 buildings of the provincial parliament, Regina has many other structures of architectural merit, among them those of the Regina College, St. Chad's College, and the provincial normal school.

The growth of Regina has been amazing. Its population increased 20-fold in the first 20 years of the present century. The town site was laid out in 1883, to serve as the seat of government of the Northwest Territories and as headquarters for the Royal Northwest Mounted Police. In 1905, when the province of Saskatchewan was formed, Regina became its capital. Population, about 40,000.

REIMS (*rēms;* French, *răṅs*), FRANCE. How would you like to go to school in a cellar, a damp and dismal cellar where no daylight ever came—and while you were learning your lessons, hear in the next block or on the next house the crash of a shell falling, and feel the air quiver with an explosion? How would you like to carry a gas-mask to school with your books, so that if you met any poison gas on your way you would be protected?

If you wouldn't care for this sort of thing, you may be thankful you didn't live in the French city of Reims during the World War of 1914–18. For the children of Reims did just this thing for nearly four years, until their city was so terribly mutilated that it wasn't possible to do even this any longer, and the people who hadn't been killed by the bombardment were obliged to flee to other cities.

Towering above the other buildings of the city in incomparable majesty, before the war, rose the giant cathedral, one of the most beautiful and most celebrated Gothic buildings in the world. On the false pretext that its towers were used by the French army as observation posts, the Germans deliberately aimed their cannon at the church, and bombarded it over and over during the four and a half years that the war lasted. All around for nearly 250 acres the houses and other buildings were completely destroyed and burned, and nearly every house in the town was hit at one time or another.

The cathedral itself was struck by hundreds of shells. The beautiful stained glass, centuries old, fell out of the windows in fragments. Many of the statues which adorned its front were broken or chipped, great holes appeared in the roof, and a fire burned out all the wooden parts of the interior. But the walls were so firmly built by the Gothic architects of long ago and the great stone-arched roof was so well vaulted that even the long bombardment was not enough to destroy the main structure.

Reims is in northeastern France, about 100 miles from Paris, on the River Vesle. During the days that France was a monarchy its kings were crowned in Reims, and it was to the cathedral of Reims that Joan of Arc brought Charles VII for his coronation by the archbishop after she had defeated the English.

The principal industries of the city are the manufacture of fine woolen fabrics and of champagne. The wine is kept in great vaults cut in the stone which forms the foundation of the city. It was chiefly in these vaults that the cellar schools were held during the World War. The name is less correctly spelled Rheims. Population, about 115,000.

REINDEER. Stories of Santa Claus and his reindeer steeds have made these members of the deer family familiar to children for many generations. They are domesticated descendants of what we call the Barren Ground caribou (*see* Caribou). Today they are kept by the people of the Arctic border of the Old World, from Lapland to Bering Sea. Domestication has resulted in changes of coat color from a uniform dull grayish-brown to white, black, or piebald.

The reindeer and caribou can be distinguished from all their allies by the fact that both sexes have antlers. These are very large in comparison with the size of the animal, and have a tine extending from the forehead forward. In the American form the brow-tine of one side is aborted and the other is largely developed. The antlers, as well as the hoofs, are used in removing snow from their food, which, in the winter, is a lichen called reindeer-moss. Reindeer are heavily built, with short sturdy limbs, sometimes attaining a height of nearly five feet at the shoulders.

THE ESKIMO'S 'LIFE INSURANCE'

The reindeer, able to subsist on tree lichens and bitter reindeer moss, represents food, clothing, transportation — life itself — to the Eskimo, the Laplander, and the northern Siberian.

Reindeer yield good milk, and their flesh is used for meat, while their skins supply material for clothing. In cold countries they fill the place of horse, cow, goat, and sheep. They are able to draw about 300 pounds over the frozen snow at nine or ten miles an hour. In much of Lapland and Siberia the land would be practically uninhabitable without these useful and picturesque animals.

Reindeer were first introduced as domestic animals in the New World a quarter of a century ago by Eskimos and Indians of Alaska and other northern regions. Since 1892 the United States government, through the Bureau of Education, has been propagating the reindeer in Alaska, so that now the 1,280 imported from Siberia have increased to over 100,000. To secure reindeer, natives must serve as apprentices in the care of the herds for four years, receiving at the end of each year a specified number of animals, totaling 30 in all. These wise governmental regulations have advanced the Alaskan Eskimos in less than a generation from the stage of nomadic hunters to the pastoral stage of civilization. It has been well said that "a reindeer herd is an Eskimo's bank account." Scientific name of reindeer, *Rangifer tarandus*.

RELIGIONS OF THE WORLD. Of the world's great religions Christianity has by far the greatest number of followers. About one-third of the entire population of the world—some 600,000,000 people—profess some form of this faith. It is the great proselyting religion. In 2,000 years of missionary work, migration, and conquest, its adherents have carried its teachings to every continent. Today Europe, America, and Australia are overwhelmingly Christian, while the Christians in Asia and Africa are steadily increasing in numbers and influence.

In the last quarter of a century, while most other religions have stood still or declined, the number of Christians has increased nearly one-fifth. In the same period the number of Mohammedans has increased one-fourth. This remarkable recent growth of Mohammedanism is due to a revival of the proselyting spirit, in which Islam has been second only to Christianity. Missionary activities and military conquests carried this faith from its birthplace in Arabia (*see* Mohammed) across northern Africa into Spain, through Asia Minor into European Turkey and the Balkan states, and east across Asia to the East Indies, until now 225,000,000 Moslems answer the daily calls to prayer. Many converts are being made in pagan countries, especially in Africa. Here progress is rapid because of the nearness of the Mohammedan countries, and the racial prejudice against Europeans and their social and religious institutions.

Numerically greater than the Mohammedans, but less aggressive, are the 300,000,000 Confucianists and Taoists of China. They are the followers of two Chinese teachers, Confucius and Lao-Tse, each of whom sought to establish a system of practical morality, Confucius emphasizing social service, and Lao-Tse passive individualism, as the means of attaining the greatest good (*see* Confucius). The original teachings of Lao-Tse have been so buried under a mass of superstition and magical practices that Taoism is today little more than a degraded system of spirit worship.

Hinduism is the chief religion of India, with about 210,000,000 adherents (*see* Hinduism). Buddhism, which also arose in India, spread over central and eastern Asia, now claiming nearly 140,000,000 adherents (*see* Buddha). In China and Japan it has existed for centuries along with the older religions, Confucianism, Taoism, and Shintoism. Shintoism, the folk religion of Japan, was largely absorbed into Buddhism when the latter faith was brought over from China. At the restoration of 1867 Shintoism replaced Buddhism as the state religion, but later it was disestablished and its rites were merely retained as part of the state ceremonials. With the spread of modern education it has rapidly declined until now it has but about 25,000,000 followers.

Judaism, the first of the great monotheistic religions (those teaching the doctrine of one God) has been carried westward by the Jewish migrations from Palestine until today three-fifths of the 15,000,000 Jews in the world are in Europe, and another fifth in America—mostly in the United States.

The Christian church has three main divisions, the Roman Catholic, Eastern Orthodox, and Protestant churches (*see* Church, Christian). No accurate figures are available, but latest estimates put the numbers of their adherents at 295,000,000, 121,000,000, and 194,000,000, respectively.

The Roman Catholic church thus includes nearly half the total number of Christians. The population of Europe, Latin America, and Oceania is predominantly Catholic, with the Eastern Orthodox church leading in the Balkan peninsula, Asia Minor, Syria, and the Russian Empire; in North America the Protestants make up nearly two-thirds of the total Christian population.

The Eastern Orthodox church, which separated from the Roman Catholic church in the 11th century, adhering to the primacy of the Patriarch of Constantinople while the Roman Catholic church adhered to the primacy of the Bishop of Rome, includes the Greek, Hellenic, Russian, Serbian, Bulgarian, Syrian, Rumanian, and other churches. Various other churches, including the Armenian, Nestorian, Coptic, and Abyssinian, which do not belong to the Eastern Orthodox communion, are generally grouped with this division.

The largest of the Protestant sects resulting from the Reformation begun by Luther in 1517 is the Lutheran church. It has some 60,000,000 adherents, about two-thirds of whom live in Germany and Scandinavia. Methodists, Presbyterians, Anglicans (including the Protestant Episcopalians of the United States), and Baptists follow. Other numerically important denominations are the Disciples of Christ (Campbellites), Congregationalists, Mennonites, Friends (Quakers), Unitarians, and the Latter Day Saints (Mormons).

With the exception of the Lutherans the greater part of these Protestant denominations are found in English-speaking countries. One of the most remarkable recent religious movements is the growth of the Church of Christ Scientist (Christian Science) which was founded in Boston by Mrs. Eddy (*see* Eddy, Mary Baker).

The comparative size of the various denominations in the United States is shown in graphs accompanying the articles on the various states. Christian Scientists are not included because no figures are available.

THE "SHAKESPEARE OF PAINTING"

This portrait of Rembrandt painted by himself mirrors the face of one who loved life through and through, from its gallant outward shows to its inner spiritual depths.

REMBRANDT (*rĕm′brănt*) (1606–1669). When Shakespeare had but ten years more to live, there was born in Leyden, Holland, a boy who was to become one of the greatest painters of all times. Just as the great English dramatist could make a truth live through the reality of the men and women in his plays, so the artist Rembrandt — Rembrandt Harmenszoon Van Rijn, to give him his full name — painted men and women so that they seem as alive now as they were 300 years ago.

Rembrandt's father, who was a miller, intended him for a learned profession, but the boy showed so little interest in ordinary studies that they allowed him to follow his own bent—painting. He studied with artists in Leyden and Amsterdam. All his early work showed his intense desire to learn to represent the lines, light and shade, and color of the people he saw about him. He made studies of every sort of person to be seen in the crowded streets. Jewish beggars and venerable rabbis, prosperous merchants, soldiers, cripples were his subjects. When he had no one else, he used himself as a model. It is estimated that he painted between 50 and 60 portraits of himself, not through any sort of vanity, but because he could use his own face as a mirror of all feelings.

In 1631 Rembrandt's work had become so well known that he moved to Amsterdam. Numerous orders for portraits were given to him as the foremost portrait painter of the day. The beautiful fair-haired Saskia Van Uylenborch, whom he married in 1634, was the model for many of his more fanciful pictures. In addition to portraits and set pieces, Rembrandt attained fame for his landscapes, while as an etcher he ranks among the foremost of all times.

It is impossible to describe the 700 pictures that Rembrandt produced, of which about 500 remain. There is one, however, which shows his powers so well that an appreciation of its excellence opens the eyes to an appreciation of all his work. That one is called 'The Night Watch' and is in the Royal Museum of Amsterdam. It is a life-sized picture of a group of 29 city guardsmen issuing for a sortie. Each man is painted with the loving care that Rembrandt gave to single portraits, and yet the composition is so wonderful that the separate figures are made second in interest to the effect of the whole. The canvas is brilliant with color, movement, and light. In the foreground are two men, one in bright yellow and the other in black. Rembrandt knew how to let the shadow of the one tone down the high light of the other. In the center of the painting is a little girl dressed in yellow. Many people wonder what she is doing all alone in that crowd of men. Joseph Israels, the great Dutch artist, says: "If Rembrandt could have heard them he would have answered with a laugh, 'Don't you see that I only wanted this child as a focus for the light and a contrast with all the downward lines and dark colors?' "

During the later years of his life Rembrandt lost some of his popularity. This was due to many reasons. The Thirty Years' War had impoverished all northern Europe, and pictures and portraits more than ever were luxuries. Many people objected to his free, independent method of work, and to his subjects. They thought that he should follow after the painters of Italy, that he should paint subjects from the history and mythology of Greece and Rome instead of from Dutch themes. Then, too, Rembrandt displeased many staid burghers by his extravagance in buying pictures of other artists. His vast collection of paintings was sold at auction before his death and he died poor and obscure. But for us he remains, as Israels says, "the true type of artist, free, untrammeled by traditions." His fame increases from year to year and his paintings are becoming almost priceless.

Besides 'The Night Watch', some of Rembrandt's chief works are: 'Marriage of Samson' and 'Wedding Breakfast' (Dresden Gallery); 'Saint Paul in Prison' (Stuttgart); portrait of his brother (Berlin); 'School of Anatomy' (The Hague); 'Syndics of the Cloth Hall', and 'Jewish Bride' (Amsterdam); 'Pilgrims at Emmaus' (Louvre); 'Family Group' (Brunswick); 'Portrait of a Man' (Windsor Castle); portrait of himself (Buckingham Palace). There are a number of Rembrandts in America in museums and private collections, among them 'The Mill' in the Widener collection in Philadelphia, and 'Girl at a Window' in the Art Institute in Chicago.

WHEN *the World of* ART AND LETTERS *was* BORN AGAIN

The New Life in Art, Literature, and Learning that Came with the Dawn of the Renaissance after the Long Dark Night of the Middle Ages

RENAISSANCE (*rĕn-ā-säns′*). The term "Renaissance" means literally "rebirth." At bottom it was an awakening of the human intellect to wider fields of activity, and a recovery of the freedom of individual thought and action, lost in the Middle Ages. It is applied especially to the revival of classical learning and to the new development of sculpture, painting, and architecture which began in Italy about the year 1300, and went on steadily throughout the 14th, 15th, and 16th centuries.

A purified and invigorated knowledge of Greek and Latin, a new literature in the languages of the people of the different countries, the introduction of the compass and of gunpowder, the invention of printing, the discovery of America, the anatomical studies of Vesalius, and the astronomical studies of Galileo and Copernicus, were some of the by-products of this quickening movement of the human spirit, whose effects have never yet wholly ceased to be felt.

Dante (1265–1321), who wrote his soul-stirring 'Divine Comedy' in Italian instead of Latin, was "the glimmer of the dawn" of the Renaissance.

Francesco Petrarch (1304–1374) was its real initiator in the field of literature and learning. He not only wrote many exquisite sonnets in Italian, but he "aroused classical antiquity from its long winter sleep," and gave direction to the talents of a hundred others. Like Dante he was a citizen of Florence, that wonderful city on the river Arno, the Athens of Italy; but both spent most of their lives in enforced or voluntary exile. The "Laura" to whom Petrarch's sonnets were addressed was a lady of Avignon, France, whose memory he faithfully cherished for many years after she was carried off by the Black Death in 1348.

There is a charming story of the lad Petrarch poring over half-understood books of Latin rhetoric and poetry to the neglect of his study of the Roman law. His angry father, after throwing the forbidden volumes into the fire, relented and allowed the boy to save his favorites, Vergil and Cicero, half-burned from the flames. Another story tells how Petrarch in later life carried everywhere with him a manuscript copy of Homer's poems, hoping always that he might find someone who could teach him enough Greek to explore that hidden world.

To only two men since his day—Erasmus in the 16th century and Voltaire in the 18th—has it been given to yield an intellectual empire over Europe so universal as was the lot of this poet-scholar of the early Renaissance.

To the studies of Petrarch and his followers, as distinguished from scholastic philosophy and theology, the name *litterae humaniores* ("more humane letters") was given. From this we derive our term "humanists" for such scholars. Classical literature not only supplied them with standards of better literary form. It disclosed "a new conception of life; a conception freer, larger, more rational, and more joyous than the medieval; one which gave unfettered scope to the play of the human feelings, to the sense of beauty, and to all the activities of the intellect."

Boccaccio, "Father of Italian Prose"

Today Petrarch's friend and fellow townsman, Giovanni Boccaccio (1313–1375), is chiefly known for his witty stories, entitled the 'Decameron', which won for him the name "father of Italian prose" (*see* Italian Literature). But even more important was his part in carrying on the revival of learning. For Boccaccio was the first Italian in seven centuries to learn to read classical Greek. In addition he wrote many Latin works of scholarship which aided in the search for and identification of the lost writings of ancient literature. Soon hundreds of eager scholars were engaged in the work of spreading abroad the "new learning," with all sorts of unsettling results.

Princes, churchmen, and nobles in Italy now gave to literature and art the attention which north of the Alps was bestowed upon the stables and kennels; and the place of the knight errant was taken by the wandering humanist, who sought manuscripts as the former had sought adventures.

And how much of real romance is packed into the history of that quest! Over 700 ancient Latin writers are known to us by name, but the works of less than a fifth of these have survived even in part. There are only 43 writers of whose works we possess the major portion.

That we have so much is due to the tireless efforts of men like Petrarch and Boccaccio; of Niccolo de' Niccoli, the collector whose 800 manuscripts form the nucleus of the Florentine library; of Poggio Bracciolini, who had great success in the monasteries of Switzerland; of Nicholas V, the first humanist pope; and of a host of others who, before the age of printing, rescued from the neglect of the Middle Ages the priceless works of the ancient Greek and Latin authors.

"The arts and the inventions, the knowledge and the books, which suddenly became vital at the time of the Renaissance," says the English author, J. A. Symonds, "had long lain neglected on the shores of the Dead Sea which we call the Middle Ages. It was not their discovery which caused the Renaissance; but it was the intellectual energy, the spontaneous outburst of intelligence, which enobled mankind at that moment to make use of them."

Two agencies chiefly helped to spread the Renaissance beyond the Alps, gave it a Christian instead of a pagan character, and made it a contributing factor to the religious Reformation. The invention of printing, about 1450, was one of these (*see* Printing); Erasmus of Rotterdam (1467–1536) was the other.

Charles Reade's 'Cloister and the Hearth' tells the story—largely by means of Erasmus' own writings—of the unhappy parentage of this great Dutch scholar. Born an illegitimate child and thrust into a monastery while still a mere boy, he became by his brilliant talents the protegé of princes and prelates. He spent his manhood in furthering the revival of Greek and Latin learning in France, England, Switzerland, and Germany—"wherever there were friends, books, and a printing press."

His 'Handbook of a Christian Soldier' was a manual of practical piety which ran through edition after edition. His 'Praise of Folly' (*Encomium Moriae*), written in England, while resting in the house of his friend Sir Thomas More after a visit to Italy, set all Europe to laughing at the hair-splitting subtleties of theologians, the slavish ceremonies of the monks, the ignorance and superstitions of the people, the luxury and neglect of duty by the heads of church and state. On the other hand his printed edition of the Greek New Testament (1516), and his editions of the writings of the early church fathers, laid the foundations for a sounder biblical theology.

Scores of scholars north of the Alps worked to the same ends; and the newly founded German universities, and the magic art of printing, carried the seeds of this Christian revival of learning far and wide over western Europe.

Revival of the Fine Arts

Parallel to this awakening of the human intellect was a great development of the fine arts. After centuries of stiff symbolic representation, artists began again to study nature herself and to work from the living model. New ideas of grace, harmony, and beauty were gained from the sculpture and other artistic remains of classical Greece and Rome. Presently came the discovery of better technical methods of execution—of the laws of perspective and the process of painting in oils. The result was that the art of painting burst into a glory previously unknown, and sculpture and architecture rivaled the grandeur of the ancient days.

As in the revival of learning, Italy again led the way, though the countries beyond the Alps soon followed. The dawn of the new age came with the sculptors Nicholas, John, and Andrew of Pisa. Contemporary with them was Giotto of Florence (1276–1336)—

sculptor, architect, painter, and friend of Dante. Ghiberti, Donatello, and Della Robbia—the latter the creator of the charming medallions of children in glazed terra cotta—continued the work in sculpture; Fra Lippo Lippi, Botticelli, Ghirlandaio, and Perugino in painting; and Brunelleschi and Bramante in architecture. The tumultuous exuberance of Gothic art gave way to the serene and rational beauty of the classic orders, the pointed arches to rounded Roman ones, the aspiration of vertical lines to the restful calm of the horizontal. St. Peter's in Rome sums up in itself the spirit of Renaissance architecture.

The full flowering of Renaissance art came in the late 15th and early 16th centuries, with Raphael, the prince of painters; Leonardo da Vinci and Michelangelo, embodiments of supreme many-sided genius. With these flourished the lesser lights—Andrea del Sarto, "the faultless painter"; Correggio, who depicts Christian saints with pagan charm and beauty; Titian, the superb master of Venetian colorists; and Tintoretto, a master of technique.

North of the Alps—in Flanders, Holland, and Germany—the chief names are the brothers Van Eyck, to whom is ascribed the chief part in originating oil painting, Albrecht Dürer and Hans Holbein, each of whom is connected with the new art of printed engraving as well as painting. The greatest of northern painters—Rubens and Rembrandt—belong to the period following the Renaissance.

The Passing of the Renaissance

But planted in the Renaissance were the seeds of its own decay. It emancipated the spirit of man, fostered individualism, and spurred him to high achievements. At the same time it brought a rapid moral decline. "The prejudices, traditions, virtues, and vices of the Middle Ages all disappeared to make way for another state of society and other men."

For the Christian ideal of holiness was substituted a frank enjoyment of life, with personal fame and historical greatness as its highest ambitions. The humanists became the natural allies of their patrons, Italian despots, whether of the good sort such as the Medici at Florence, or monsters of iniquity like the Sforzas at Milan. The Florentine Machiavelli gathered into his work 'The Prince' all the cold, calculating, unscrupulous maxims that marked their new statescraft.

In the end the study of Greece and Rome, instead of being a stimulus, became a deadening influence. Literature sank into mere imitation. No word or phrase was considered good unless it could be found in Cicero. Art became hackneyed and stilted. Popes and cardinals invoked Christ and the saints under the names of pagan deities and demigods. The world grew tired of such pedantry. Then came the storm of the religious Reformation to clear the air.

For additional information *see* the related articles:

Architecture
Dante Alighieri
Dürer, Albrecht
Florence, Italy
Ghiberti, Lorenzo
Giotto
Holbein, Hans
Italy
Medici
Michelangelo
Painting
Raphael Santi
Reformation,
Rome, Italy
Sculpture

REPTILES. The "creeping creatures" that we call reptiles—the tortoises, crocodiles and alligators, lizards, and snakes—have an exceedingly ancient and important history. Some millions of years ago their ancestors ruled the earth. Among those ancient reptiles were the largest land monsters that ever lived—the dinosaurs (*see* Animals, Prehistoric). Among them also were the ancestors of the birds and the mammals. At the other end of the chain, the reptiles are believed to have developed from the "amphibians" or "batrachians," of which frogs, toads, newts, and salamanders are the modern representatives; and these, in turn, probably developed from the fishes. In this way the reptiles occupy an important central position in the evolution of vertebrate or "backboned" animals. (*See* Animal Kingdom.)

Today the reptile class has fallen from its high estate. With the exception of certain groups of snakes, the reptiles as a whole appear to be degenerating and dying off. They have been greatly reduced in numbers as well as in size, the crocodile being the largest living representative of the class. Science describes a reptile as a cold-blooded lung-breathing creature, with a scaly skin, whose skull is connected by a single bone-end or condyle. More than 20 groups flourished during the "Age of Reptiles," whereas but four groups now remain. One of these groups contains but a single living species, the "tuatera" or *Sphenodon* of New Zealand, a curious survivor from prehistoric days (*see* Lizards; Snakes).

Scientific names of living sub-classes of reptiles: Tortoises, *Chelonia;* crocodiles and alligators, *Crocodilia;* lizards and snakes, *Sauria;* tuateras, *Prosauria.* The chief extinct sub-classes of reptiles are the dinosaurs, land-living monsters; the plesiosaurs, aquatic, with long necks and paddle feet; the ichthyosaurs, whale-shaped sea-dwellers; and the pterosaurs, or flying reptiles.

RESINS. The most common resin, known as "rosin," is that obtained from the distillation of the sap or crude turpentine of the long-leaf pine of the southeastern United States. It is largely used in paints and varnishes and in the making of laundry soap and sealing wax, and to rub on the strings of violin bows to keep them from slipping. Among the many other resins are the odorous asafoetida, which is the dried and milky juice of the roots of certain plants of western Asia; gamboge, the brownish resin obtained from these plants in Cochin-China and Siam used as a yellow pigment and sometimes in medicine; myrrh, the fragrant resin of several plants in Arabia and Abyssinia, which is so largely used in the manufacture of incense and perfumery and also in medicine. The "dammar" resins from several different coniferous trees of India, New Zealand, Australia, and the East Indies are widely used in making varnishes. The Amber is really a fossil resin (*see* Amber).

It is possible to extract resins from nearly all plants with alcohol. The test of the difference between gums and resins is that gums dissolve in water, but not in alcohol, and resins dissolve in alcohol but not in water. (*See* Turpentine.)

BREATHING, *the Mainstay of* ALL LIFE

With every breath we draw, millions upon millions of tiny red corpuscles go coursing through our arteries bearing life-giving materials to the tissue of the body. Gills, lungs, and the skin are organs of animal respiration; and plants, too, have their own marvelous system of taking oxygen from the air.

RESPIRATION. In animals respiration or breathing is carried on by two kinds of organs—gills and lungs — and some lower creatures breathe through their skin. Gills are adapted for respiration in water, and lungs for action in free air. Gills are found in clams, crawfish, squids, and some other invertebrates, as well as in all fishes.

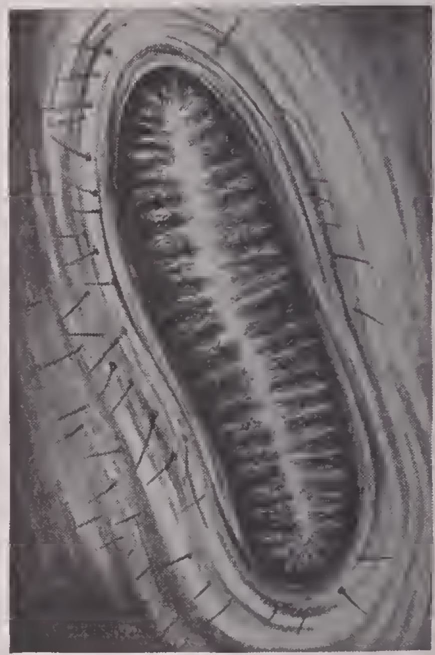
HOW A FISH BREATHES

Water is drawn into the mouth and forced through the gill fringes shown above, which absorb the dissolved oxygen; then it passes out again through the gill slit.

The essence of respiration consists in an exchange of oxygen and carbon dioxide (CO_2) between the living cells and the air. Special organs of respiration are not necessary to accomplish this end. The earthworm, for example, breathes through its skin—that is, the blood comes close to the surface in thin-walled vessels, and the exchange between it and the air is accomplished. Oxygen enters the blood from the air and carbon dioxide passes from the blood into the air. In the simplest animals, like the amoeba, where there is no blood, the breathing is done by the protoplasm of the body, but the exchange of carbon dioxide for oxygen is essentially the same as in higher animals.

It must also be understood that respiration in plants is of the same nature as in animals. In breathing they take in oxygen and give up carbon dioxide at all times. It is easy to point out how the erroneous idea that plants breathe carbon dioxide and give off oxygen arose. Plants use carbon dioxide in their process of nourishment, and they return free oxygen to the air as a left-over product. This comes from the process of starch-formation; and, as that process takes place in the sunlight, it was at first supposed that the oxygen was set free in daylight from the process of respiration. But the two processes are quite distinct.

A SIMPLE AIR HOLE



This is the "spiracle" or breathing hole of a silkworm, which takes the place of the fish's gills and the complicated breathing apparatus of higher animals.

Fishes possess gills throughout life. The amphibia have them in larval stages, and, in some forms, both gills and lungs exist in the same individual. Insects have air tubes extending through the body. Lungs occur in all animals of a higher grade. They are developed in all animals as saclike expansions of the walls of the pharynx, blood-vessels are spread over them, and air is introduced into the inside. (*See* Blood; Lungs.)

A Breath of Fresh Air—What It Means

EVERY moment of our lives our bodies are being poisoned, yet the span of a man's life is three score years and ten. All through these years a breath of fresh air stands between us and the grave.

It is not surprising that this simple act of breathing is governed and protected by amazing living machinery found in the human body—machinery almost as marvelous as that by which we think and remember. Every breath you take is moistened and warmed and filtered before it reaches the lungs, which send the valuable part of it on its journey through your system. Millions of elastic fibers are stretched every time you breathe, increasing the capacity of the lungs. The cavities of the nose present moist surfaces in order to protect you from dust, though there are still silly people who breathe through the mouth and lose the value of this safeguard. Down in the small tubes of the lungs the walls are covered with rapidly beating hairs (cilia) that catch dust and carry it back to the throat, whence it may be coughed out.

We walk out in the country, drinking in the glorious air of a fine morning, and in a minute we have filled our lungs with a fresh supply of the very source of life; and from the lungs, through a folded-up surface that would cover a large dining-room, the fresh air pours itself into the stream of blood that flows forever through our bodies. To understand what happens now to our breath of country air we must explore this wonderful river of life—as full of living things as the sea, ever flowing between miles of walls that hem it in and keep it on its way, constantly changing its composition in accord with the activity of the different territories through which it passes, carrying in fresh air and taking out bad, conducting water all over the system, taking food where it is needed, and bearing along its course a ceaseless patrol of watchmen and police.

A chemist will tell you that no laboratory in the world has ever yet found anything else so remarkable as a drop of blood. The blood that oozes from your finger when you prick it with a needle brings out with it millions of lives. The complete history of that drop of blood would need an encyclopedia to itself, and what we know of it is almost nothing compared with what we do not know. We know something of three of its constituents, because they are familiar gases; we know almost nothing at all of one other constituent, the little blood-plates that crowd together in their millions; but about two inhabitants of this drop of blood we know enough to make up a story a hundred times stranger than fiction. They are the red cells and the white cells (corpuscles) of the blood, and in the drop of blood that comes from a pin-prick there are more of these marvelous creatures, living and working, than there are people in the city of New York.

It is the little red cells that take up oxygen from our breath of fresh air and carry it on its way, and the wonderful thing the red cell uses to carry oxygen has the strange name of hemoglobin. It has baffled and bewildered every chemist who ever tried to understand it. The smallest bit (molecule) of it that can exist is made up of two thousand atoms, and one of these atoms is iron, which gives the color to your face, because hemoglobin is the coloring matter of the blood.

What the Red Cells Do with That Fresh Air

Thus the smallest visible thing that this red-cell porter carries has a thousand parcels to carry with it; and iron, which gives a little girl her rosy cheeks, is only one of them. Another is oxygen, which the red cell picks up from your breath of country air. Every minute every red cell in your body calls at the lungs for oxygen; in its life, which perhaps lasts about a fortnight, it is filled about 20,000 times with fresh air, which is emptied into the remotest tissues of the body. If we imagine a city in darkness, and a switch suddenly turned on to fill it with light, illuminating its foul slums and cellars, shining on its turrets and towers, penetrating its secret chambers, and flooding with light its public places, we can imagine what the red cell is doing at this moment with the last breath of life we drew into our lungs.

That is the everyday work of the red cell. What does his white brother do? The white cells are the police of the body, ever watchful for invaders, creeping through the wall of blood-vessels after enemies (bacteria) and devouring them. They are a navy in the blood, and if the enemy leaves the sea they instantly become an army and follow him on land, pursuing him ceaselessly till he is conquered or they themselves are dead. They come together as an incredible host wherever they are wanted. They are the noblest army upon the earth guarding the lives of all mankind, rarely failing in their duty, however great the odds may be against them, protecting alike the lives of murderers and of little children.

Remember what it is that happens when you prick your finger. The blood that was running the moment before is built up into a solid wall. The marvel of marvels is this element in the blood whose great business it is to make it solid if it threatens to escape. An almost incredible thing that is, in itself; but even more incredible is the fact that the substance that solidifies the blood is made in an instant when it is wanted, and does not exist at any other time, although the materials for it are always in existence in the blood.

The Mysterious Cell Factory in the Bones

A similar thing happens with red cells. The ordinary red cell has no nucleus. But let the body suddenly lose a great number of red cells, and be in desperate need of more, and very soon young red cells, each with a nucleus, appear and may be put into use before they can get rid of their nuclei, though most of the new ones are properly finished and without nuclei. The red marrow of the bones builds up red cells at the rate of many millions in a minute, until they have restored the proper balance in the blood and filled up the gap. How does the red bone-marrow know when they are wanted, and make them so quickly? It is making some red cells all the time. How does it know that more are needed? Of course the marrow doesn't "know," but what makes it change its rate of manufacturing? It is one of ten thousand questions about the body that no man on earth can answer.

A man's blood, your doctor will tell you, is as personal as his face. It is impressive to think of this river of life, running through miles of living tubes within our bodies; picking up one substance here and another there; carrying new strength to the remotest corners of our system; coming with a special rush to a man's brain if he happens to be thinking hard; ventilating the different parts of our bodies, from the toes to the brain and the finger-tips; carrying off the poisons our bodies are making every minute; keeping life within us ever fresh and sweet; and bearing along its course not only the materials for building up the body anew, but a whole host of architects and builders and sculptors who repair the body as it wears away. This it does in all of us; but in each of us it does things peculiar to ourselves as well.

And what your next breath of fresh air will do is to keep the river in your veins sweet and clean; it is the guardian of the purity of the river of life running through your veins.

REVERE, PAUL (1735–1818). Paul Revere aided the cause of the colonies during the entire War of Independence, but most of us associate his name with his famous ride from Boston to Lexington to warn the militia of the approach of the British soldiers.

Revere was a Boston goldsmith. He had been a member of the party that destroyed the tea in Boston harbor, and in 1775 was at the head of a committee to watch the movements of the British troops. When it was known on the night of April 18 that the latter intended to march to Concord, Revere "silently rowed to the Charlestown shore," where he waited for the signal light in "the North Church tower." As soon as he saw the signal, showing that the troops were actually on the way, he rode to Lexington, rousing the minutemen on his way. At Lexington he was captured by the British and held during the day, but a companion got through to Concord.

During the war Revere rose to the rank of lieutenant-colonel. He established a powder-mill for the colonists, and engraved the first Continental money.

The WAR *that* WON AMERICA'S FREEDOM

The Struggle between Great Britain and Her American Colonies—How America's Great Revolution Helped to Win Liberty for England and Other Lands as Well

REVOLUTION, AMERICAN. At the close of the French and Indian War (1763) the relations of the colonies to Great Britain had for a very long time been very friendly and cordial. The colonists had been allowed to govern themselves in all local affairs in their own legislatures. Laws passed by the colonial assemblies were often vetoed by the governor or by the king; but the British Parliament had never, except in a few minor cases, passed laws regulating the internal affairs of the colonies, and especially had never laid a direct internal tax on the colonies.

March 5, 1770 — Efforts to enforce the "Stamp Act" result in the "Boston Massacre."

It was understood that the Parliament could regulate the trade of the empire as a whole; and beginning about 1660 the Parliament had passed a great many "Trade and Navigation Acts" for this purpose. These Trade Acts were designed to compel the colonies to sell in British markets certain commodities which could not be raised or made in Great Britain, and to compel them to buy from British merchants most of the things they did not make or raise themselves. Some things, such as ironware and textiles, the colonies were forbidden to manufacture because such manufactures would interfere with the profits of British merchants. On the whole the Trade Acts were about as advantageous to the colonies as to Great Britain, for if they required the colonies to buy certain things of British merchants, they equally required the British people to buy certain things of colonial merchants. Besides, the Trade Acts, where they were found to interfere seriously with colonial commerce, were not enforced to an injurious extent.

Dec. 16, 1773 — The "Boston Tea Party" again warns the British of the danger of revolt.

Nevertheless, the right to regulate colonial trade was admitted to be the chief advantage which Great Britain obtained from the possession of colonies. In return for this advantage, it was understood that Great Britain should furnish the colonies naval protection for their trade, and defense against foreign conquest, at her own expense. In case of war the colonies were expected to defend themselves against the French and the Indians on land. During the French and Indian War, the British government had sent land forces to America to help fight the French and Indians, and in addition had helped pay for the 25,000 troops which the colonists furnished for that war. As a result of the war, the British debt was greatly increased; and the British possessions in America were increased by the conquest of Canada and the acquisition of the territory between the Allegheny Mountains and the Mississippi River.

When the war was over the British government, therefore, decided to adopt a somewhat different policy of managing its possessions in America. It decided to establish permanently in America some British troops to maintain its hold on Canada, and to protect the colonists against the Indians; and to prevent Indian wars it took over the control of land grants within the western territory and of trade with the Indians. To meet the additional expense of maintaining troops in America it determined to raise a revenue in the colonies, on the ground that the colonies ought to help pay for their own defense; and for this purpose the Parliament passed the Sugar Act in 1764, and the Stamp Act in

1765 (*see* Stamp Act). At the same time measures were taken for enforcing more rigidly the many provisions of the various Trade and Navigation Acts.

The colonies objected to this new policy, partly because it was new, partly because they were now beginning to feel that they were strong enough to take care of themselves, and partly because they wished to get possession of the rich western lands without any interference on the part of the British government. In addition, they objected particularly to the Sugar Act because it interfered seriously with colonial commerce with the West Indies, and would, so they thought, tend to destroy certain flourishing colonial industries. They objected still more to the Stamp Act because it was a direct tax, and they reasoned that if the British Parliament could lay a stamp tax it could lay a land tax, or any other kind of tax, and by the taxing power it could destroy their long established privilege of self-government.

March 23, 1775 — Patrick Henry sounds the call to arms in his famous Virginia Speech.

In 1766 the Stamp Act was repealed and the Sugar Act was modified; but in 1767 the British Parliament once more tried to raise a revenue in the colonies by laying certain customs duties on glass, paper, lead, and tea. The colonies, in objecting to the Stamp Act, had developed the theory that Parliament had no constitutional right to levy an "internal" tax, admitting by implication at least that it might lay an "external" tax. The Townshend duties (as they were called) on glass, paper, lead, and tea were "external" taxes; and since the colonists objected to them as much as to the Stamp Act they had to elaborate their theory of colonial rights a little. The difficulty was that they had always admitted the right of Parliament to regulate trade, and in order to regulate trade to lay duties on imports. How could they then object to the Townshend duties without at the same time denying Parliament the right to regulate trade? They got out of this difficulty by saying that Parliament might lay duties intended primarily to regulate trade, but could not lay duties intended primarily to raise a revenue. The Townshend duties were expressly intended to raise a revenue.

April 19, 1775—The first shots of the Revolution are fired at the Battle of Lexington.

April 19, 1775 — The American militiamen fight off the British at Concord bridge.

Resistance to the Townshend duties created much disturbance in the colonies. "Non-importation agreements" were again formed, as in the time of the Stamp Act. To enforce the collection of the duties British troops were sent to Boston, resulting in conflicts between the citizens and the troops which finally ended in the killing of four citizens by the soldiers (the so-called "Boston Massacre," 1770). On the ground of extreme provocation by the mob, the soldiers were acquitted (except two), John Adams undertaking their defense.

In the end the duties were all repealed except the duty on tea (1770). For two years the dispute seemed to be over; but in 1773 it was revived again in a more serious form when the British government passed a law to aid the British East India Company in disposing of its surplus tea in the colonies. Tea which the company sent to Boston was thrown into the harbor by men disguised as Indians (the "Boston Tea Party," 1773). To this act the British Parliament replied by passing with great majorities the Coercive Acts, which closed the port of Boston, remodeled the government of Massachusetts, quartered British troops on the inhabitants, and permitted men to be taken to England for trial in certain cases. To meet this emergency the first Continental Congress was assembled at Philadelphia Sept. 5, 1774. Shortly afterward armed conflict was precipitated by the battles of Lexington and Concord.

During the years 1768–1775, the colonists had greatly modified the theory on which they made their stand. Until 1768 the cry was generally, "No taxation without representation." But certain actions of the British government, such as the suspension of the New York legislature and the attempt to make the Massachusetts assembly rescind the circular letter which it sent to the other assemblies in 1768, made it clear that they might be oppressed in other ways than by taxation. If the British government could abolish the colonial legislatures it could destroy colonial self-government, even if it did not tax the colonists. From this time, therefore, the colonists began to maintain that Parliament had no right to legislate for the colonists in any way. In 1765 Benjamin Franklin did not think that even the Stamp Act was unconstitutional; but by 1768 his ideas had greatly changed. "The more I have thought and read on the subject," he said, "the more I find myself confirmed in opinion that no middle ground can be well maintained; I mean, not clearly with intelligible arguments. Something might be made of either of the extremes: that Parliament has a power to make all laws for us, or that it has a power to make no laws for us; and I think the arguments for the latter more numerous and weighty than those for the former." Jefferson and many others soon came to accept this view of the matter; and it was this advanced theory of the relations of the colonies to Great Britain which we find expressed in the Declaration of Independence. The Declaration does not mention Parliament, but makes all the charges of tyranny against the king, on the theory that the colonists and the English people were separate and free peoples who had united in a kind of federation under the same king. Therefore they declared their independence of the king only, since it was the king only to whom they had ever been subject.

June 17, 1775 — The Battle of Bunker Hill proves the colonists' stubborn courage.

July 4, 1776 —The Declaration of Independence is adopted by the united colonies.

The struggle upon which the colonists embarked at the battles of Lexington and Concord, April 19, 1775, was in a sense a civil war (*see* Lexington and Concord, Battle of). Thousands, perhaps even a majority, of the colonists at first hoped for reconciliation with the mother country; but after several fruitless attempts at a peaceful settlement they were forced either to side with the "rebels" or with those who continued to uphold England. The latter called themselves "Loyalists," but to their exasperated neighbors they were always "Tories." But if there were Loyalists in the colonies, there were also protesting voices in England, who rejoiced with William Pitt, Earl of Chatham, that America had resisted and felt that "three million of people so dead to all feelings of liberty as voluntarily to submit to be slaves would have been fit instruments to make slaves of all the rest." (*See* Chatham, Earl of.)

Dec. 25, 1776 — Washington crosses the Delaware by night to surprise the Hessians.

When the Second Continental Congress met on May 10, 1775, it was confronted by the fact that a battle had already occurred between the colonial militia and the British troops; that a crowd of farmers and mechanics were besieging the British in Boston; and that the old governments of the colonies were disorganized. So it took matters into its own hands; advised the separate colonies to set up new governments; adopted the militia about Boston as the Continental Army, and appointed George Washington its commander-in-chief.

Two days after this appointment was made, the battle of Bunker Hill was fought (*see* Bunker Hill, Battle of). Crown Point and Fort Ticonderoga had already been captured by the colonial forces, and a fruitless expedition had been sent against Canada. But the colonial troops were not yet in condition to fight, and the most of the year 1775 and until the spring of 1776 Washington spent in drilling his raw recruits into an army, in the meantime keeping the British shut up in Boston.

In the spring of 1776 the British "red-coats" were forced to leave Boston and sailed away to Halifax in Nova Scotia. There in this loyal port the British prepared their next campaign. New York was to be conquered first. This would divide the colonies and then it would be comparatively easy, so the British thought, to crush New England, the chief seat of the rebellion.

In August, when General Howe began to carry out this plan, it looked as though it would quickly be successful. He forced Washington and his little army to retreat from Long Island. He leisurely followed them up the Hudson River and back into New Jersey. Things looked dark for the Americans. Many of Washington's men had enlisted for three months only. When their time of service was ended they returned home. Congress fled in a panic from Philadelphia to Baltimore. In spite of the Declaration of Independence, which had been issued by the united colonies on July 4, 1776 (*see* Declaration of Independence), General Howe felt that the rebellion was practically at an end. On November 30 he offered pardon to all who would take the oath of allegiance to the mother country, and it was taken by hundreds.

Suddenly a rift appeared in the clouds. On the night of December 25, Washington and his tattered troops crossed the Delaware in the teeth of a raging snow storm and surprised and captured a number of Hessian troops, hired by the British government from a petty German prince. A week later they gained a brilliant victory over the British forces at Princeton, and went into winter quarters in the neighborhood of Morristown.

Dec. 26, 1776 — The Hessian general, Rahl, is mortally wounded at the Battle of Trenton.

When spring came the British planned to carry out their scheme of the previous year, to conquer New York and thus break through the line of the colonies. General Burgoyne started from Canada with a well trained army. He easily captured Fort Ticonderoga, but as he moved south along the Hudson, the militia of New England gathered to oppose his progress. Men who had refused to serve in the Continental Army now rose to drive out the invader. At Bennington, Vt., they easily defeated a detachment of the British. By the time Burgoyne reached Saratoga, N.Y., the colonial forces far outnumbered his own. Twice he attempted to break through the American lines, but twice he failed, and finally, on October 17, he and his whole army were forced to surrender to the American commander, General Gates, at Saratoga Springs.

Oct. 17, 1777 — General Gates receives the surrender of Burgoyne at Saratoga Springs.

Burgoyne was not to blame for this disaster. He had expected General Howe to come up the Hudson from New York to aid him. But Howe waited to capture Philadelphia before he left for the north. Washington could not hold the city against him. His army was too weak to risk frequent battle, and both at Brandywine and Germantown the Americans were defeated. But Washington's resistance delayed Howe's entrance into Philadelphia until September 27, and by that time Burgoyne's army was doomed.

Oct. 19, 1781 — Cornwallis' surrender at Yorktown puts an end to the war.

In spite of the surrender of Burgoyne, the winter of 1777–78, spent by Washington at Valley Forge, was the darkest period of the war. The British, comfortably housed in Philadelphia and New York, were able to purchase abundant supplies from the farmers because they could pay with gold; while the patriot who would supply food to Washington's starving men must accept "continental" paper money, which was so worthless that the expression "not worth a continental" is still used in current speech.

Even this difficulty might have been met had it not been for the inefficiency of the Continental Congress. The able men who had originally been delegates in that body were by 1778 serving either in the field or in the government of their own states, thus leaving the direction of national affairs to second-rate men who thought they knew how to run a war and worried Washington almost to distraction. As if these difficulties were not enough, a plot known as the "Conway Cabal" was set on foot to take command of the army away from Washington and give it to General Gates (*see* Gates, Horatio). Fortunately the intrigue was discovered before it was fully developed, though not before prominent men in the army and in Congress had become involved in it.

Though things looked dark during that winter of 1777–78, the crisis of the war had really passed with the surrender of Burgoyne. When the news of that victory was carried to France by John Paul Jones, that country decided to come openly to the aid of America. Up to this time numbers of French soldiers, the most prominent of whom was Lafayette (*see* Lafayette) had joined the American army, and the French government had secretly supplied money and munitions to help in the cause. Now she made an open alliance with the United States (1778), agreeing to keep up fighting until victory. Spain entered the war in 1779 in a vain attempt to win back Gibraltar; and Holland was forced to declare war against Great Britain for trade reasons. Thus the war which had been merely a colonial struggle was transformed into a world conflict. To this, as much as to their own fighting ability, the colonists owed their ultimate success.

The failure of Howe to crush the rebellion and the final disaster at Saratoga led to his recall; his place was taken by General Clinton. Clinton was ordered to abandon Philadelphia, and in June 1778 he crossed over into New Jersey with the intention of returning to New York. Washington's army followed him, and on June 28, when Clinton's army was near Monmouth Court House, Washington saw a good opportunity to inflict a serious defeat. The attack was made by Gen. Charles Lee. For a time everything went well, and Clinton's army was partially surrounded and seemingly in desperate straits. Then for some reason which has never been cleared up to this day, Lee ordered a retreat. Washington, seeing the mistake, rode up, relieved Lee of the command, and attempted to retrieve the situation. It was then too late, and Clinton's army escaped to New York. The battle might have been a decisive one, save for Lee's extraordinary action. When Washington rode up to relieve Lee of the command, he gave vent to one of those tremendous bursts of indignation and profanity with which the Father of his Country sometimes relieved his pent-up feelings.

In the northern colonies the only other events which call for notice are the storming of Stony Point by "Mad" General Anthony Wayne (1779) and Benedict Arnold's treasonable attempt to surrender West Point in 1780 (*see* Arnold, Benedict). Indian raids stirred up by the British led George Rogers Clark, under a commission from Virginia, to attack the British-held posts of Vincennes, Ind., and Kaskaskia, Ill., a conquest which helped to secure the Northwest for the United States in the peace treaty of 1783.

British Successes in the South

Although the British had failed in the North and had lost the Northwest, they at first seemed successful in the South, to which the seat of the war was now transferred. In December 1778 they captured Savannah, Ga., and an attempt by the Americans to retake it the next year failed. Georgia was thoroughly conquered. Then the British moved on into South Carolina, and on May 12, 1780, took Charleston. In August they defeated and practically destroyed the American army under Gates at the battle of Camden.

A new army must then be raised to carry on the conflict. While this was being done, the struggle was kept up by bold Southern raiders, like Francis Marion and Thomas Sumter, who with their little bands of followers would swoop down upon a small detachment of "redcoats," and then dash away to their hiding places in the trackless swamps (*see* Marion, Francis).

Although the new American army of frontiersmen defeated the British in the battle of King's Mountain on Oct. 18, 1780, it was not strong enough to stand the continual hammering of the British. Slowly Greene and his men were pushed back through South Carolina into North Carolina. At Guilford Court House they were defeated, but many British were killed. The scene then shifted to the vicinity of Yorktown, Va., whither Cornwallis had advanced to join an expedition that Clinton had sent by sea from New York. The poorly equipped troops with which Lafayette and Steuben there confronted the British seemed to hold no menace. But suddenly Washington gave up the siege of New York, marched his combined Continental and French forces to before Yorktown, and the French Admiral De Grasse appeared with a fleet in the Chesapeake, temporarily giving the Americans command of the sea. Shut up by land and sea, Cornwallis, after a 20 days' siege, had to surrender his army of 7,000 men (Oct. 19, 1781).

The End of the War

This victory at Yorktown was decisive. "The play is over," wrote Lafayette; and when the news reached Lord North, the head of the British ministry since 1770, he too cried, "It is all over." A new ministry, more favorable to the colonists, took the place of North's cabinet.

It was nearly two years, however, before the final treaty of peace was signed. In part the delay was due to the opposition of France to the claims of the Americans, which they regarded as excessive. Finally, the American representatives, Benjamin Franklin, John Jay, and John Adams, took matters into their own hands and signed a preliminary treaty of peace with Great Britain (Nov. 30, 1782), without consulting France. Nearly a year later the final treaty with Great Britain was signed at Paris (Sept. 3, 1783). It recognized the independence of the thirteen colonies and granted them all the land east of the Mississippi River except Florida, which was returned to Spain to compensate her for her failure to recover Gibraltar. Favorable terms were also granted the United States concerning the fisheries off Newfoundland, and on other points.

The result of the war was not merely to set up a new and independent republic across the Atlantic. It gave a great stimulus to the movement for liberty all over the world, and helped Englishmen at home to secure political reforms that otherwise might have been long in coming. Its influence can also be distinctly traced in the revolt of the Spanish colonies, which within 40 years converted all these former dependencies of South and Central America into independent states, with their feet planted in the path of liberty and self-government.

RHETORIC (*rĕt'ō-rĭk*). Grammar teaches the proper uses of words and how to combine them correctly into sentences. Rhetoric goes farther and teaches us to speak and write not only correctly but *effectively*—so as to produce a desired impression upon a reader or hearer. Grammar says, "This is right, that is wrong." Rhetoric says, of two or more ways of putting an idea, "*This* is the best way to convey the thought." Rhetoric seeks not only correctness, though this is of course always the first essential, but also *clearness*, *unity*, *force*, and *beauty* in expression.

Rhetoric was first taught by the ancient Greeks and meant originally the art of the orator, of speaking so as to persuade or move others. The methods used by the rhetoricians were not always the highest, for some of them did not scruple to "make the worse appear the better cause," aiming at success rather than truth. The abuse of the art of rhetoric accounts for the use of the term, as we sometimes hear it, in the sense of affected and artificial language. However, Aristotle (*see* Aristotle), who in the 4th century B.C. wrote a treatise on rhetoric which has never been surpassed in grasp of the scientific principles of writing, taught that this was not true rhetoric; and all who have thought deeply about the subject agree that no tricks of expression can take the place of sound reasoning, and that power and true beauty go hand in hand with sincerity.

In later times, especially since the invention of printing, writing has come to be more important than oratory; so rhetoric has become concerned more with the art of writing than with that of speaking. But it is well to remember its connections with oratory. If in writing we put ourselves in the place of the orator, who must so express himself that his message will strike home to his audience. we shall write more clearly, and, what is hardly less important, more suitably. We shall be less likely to make such bad mistakes as using flowery poetic language in a business letter, or colloquial language in an essay on a lofty subject. We shall be able to write more interesting stories if we have in mind someone listening to these stories; we can write better descriptions if we are trying to make someone else see what we see.

Important as is the study of the rules and principles of rhetoric, no one claims that this study alone will make a writer. As a student once wrote at the close of a course in rhetoric—

> You may study facts and methods
>   Till your form is worn and thin,
> But the way to fame in writing—
>   Take your pen and then begin.

"Learning by doing" is a safe motto in this as in everything else, and practice in writing is of the first importance. Consequently rhetoric as it is taught in schools and colleges consists largely of writing "themes," using the principles of rhetoric as a guide and as a means of correcting mistakes and improving one's style. (*See also* Figures of Speech.)

RHINE RIVER. Since the Allied occupation of the left bank of the Rhine, following the armistice with Germany in November 1918, this important river of Germany has acquired a new interest for Americans. It is one of the most noted rivers in the world, alike from the standpoint of history, scenic beauty, and commercial importance.

The Rhine takes its rise among the Alps of Switzerland, and after a northerly course of about 850 miles empties into the North Sea. The area drained by the Rhine and its feeders is estimated at nearly 100,000 square miles. It is divided into the upper, middle, and lower Rhine, the first being the river from its mountain source to Basel, the second its course from Basel to Cologne, and the third its course from Cologne through the Netherlands to the sea, into which it empties by mouths forming an extensive delta.

Canals connect the Rhine with the Rhone, the Danube, and other rivers, opening lines of water communication with France and Belgium on the one side and with the Netherlands and every part of Germany on the other. The Moselle joins the Rhine at Coblenz nearly opposite the confluence of the Lahn. It is the largest tributary, and the Moselle from Coblenz to Trier is fully as beautiful as the Rhine itself.

The falls of the Rhine at Schaffhausen are to Europe what Niagara is to America. The picturesque castles and terraced vineyards of its middle course make a trip on the Rhine one long to be remembered. Among many points of interest are the castles of Rheinstein, Rheinfels, Drachenfels, and Stolzenfels (the latter a modern restoration), the frowning fortress of Ehrenbreitstein—the "German Gibraltar"—quaint old Bingen with its "Mousetower" where the avaricious Bishop Hatto was devoured by rats, and the great gray rocks where once the Lorelei,

THE CASTLED BANKS OF THE MAJESTIC RHINE

Nine miles south of Coblenz the Rhine sweeps in a double curve past the tiny town of Boppard with its ancient Celtic name, its Roman ruins, and its 12th century castles. This scene is typical of the beautiful Rhine valley.

with her golden hair and ravishing beauty, lured mariners to destruction. Important cities on the Rhine are Strasbourg, now returned to France after 40 years' captivity; Spires and Worms, towns of Reformation memories; Mainz and Cologne, seats of Catholic archbishops whose great cathedrals tower over the modern buildings; busy industrial Mannheim, and Coblenz, occupied by the American troops as one of the three "bridgeheads" of the Rhine following the armistice.

INDIAN RHINOCEROS

The horn of the Rhinoceros is a mass of tough fiber growing from the skin, and is not part of the skeleton.

By the peace terms adopted at Paris in 1919, Alsace-Lorraine was returned to France and all other German territory west of the Rhine was to be held by the Allies for 15 years as security for the payment by Germany of war indemnities.

RHINOC'EROS. Tiger's claws and lion's teeth have no terror for the rhinoceros. He wears a skin-armor so thick and tough that even the sharp spear of the native hunter cannot pierce it. And this great lumbering creature, for all its 5,000 or 6,000 pounds, can crash through the jungle at such speed and use its terrible horn in such a way as to keep even the king of beasts at a respectful distance.

THE REAL "UNICORN" IN ALL ITS GLORY

The scientific name of the Indian Rhinoceros is *Rhinoceros unicornis*, but, with its clumsy body, thick, welted skin, and nightmare head, is as unlike the graceful Unicorn of fable as anything could be.

Its appearance is not attractive. The legs are short and thick, its feet broad and heavy with toes incased in hooflike nails. The small tail ends in a tuft, and the large piglike head is surely as ugly as nature ever formed. The dull-sighted eyes are small, the keen ears large and erect. The upper lip, which is long and pointed, reaches out and over the lower, and above it on the extended nose is the great horn that may be from one to two or more feet long. As if this were not enough, nature has given some species a second and shorter horn just back of the first.

With its horn the rhinoceros not only defends itself but easily uproots the shrubs and young trees, on the roots, leaves, and fruit of which it feeds. It is with this horn too that the mother pilots her calf about the jungle. It runs in front of her and she seems to guide it by holding the tip of her horn against its rump. No matter what the change of pace, the horn always seems to keep the same position.

Except elephants, the rhinoceros is the largest earth-living animal. Of the five species now found, the largest stands six feet six inches high. Once, ages ago, rhinoceroses much larger ranged over both the Eastern and Western hemispheres and fossil remains 15 feet long have been found in England. Now, however, they run wild only in Africa and Asia. It is the Indian one-horned rhinoceros about four to four and one-half feet high that is most often seen in captivity.

AFRICAN RHINOCEROS

The lumpy head of the square-mouthed Rhinoceros of Africa is adorned with two horns.

The habits and appearance of the species differ. The grayish-black skin of the Asian species is arranged in great folds that give it the appearance of plates of heavy armor. The African rhinoceros has a smoother skin with less marked folds. Some live on plains, some in swampy jungles. Generally they sleep during the day and move about in the cool of the evening and at night. Unless molested they are peaceful, but when brought to bay or wounded are so fierce that a rhinoceros hunt is one of the most exciting of jungle experiences. They are generally hunted with tamed elephants.

But the rhinoceros has one enemy that does not in the least mind its raging. A certain fly creeps between the folds of the leathery skin and there burrows into the sensitive flesh. Now all the great strength of the rhinoceros will not help him. He must wade into the water and wallow in the mud until he rids himself of the pests. The horn-bill, a tropical bird, is fond of these particular flies, and a strange partnership is the result. The rhinoceros gives the bird the freedom of its body on which it alights to poke its bill into the skin folds. And in return for a meal of flies, it acts as eyes for the short-sighted monster, for if an enemy approaches, it flutters before the rhinoceros uttering warning cries.

The full-grown rhinoceros, quietly munching hay in the zoölogical garden, is little like the raging beast of the wilds, but that is because it was captured when a baby. Capturing a young rhinoceros is a long and dangerous task. It may take weeks to locate a female rhinoceros with a calf young enough to be transported to the far distant zoo. When the haunt of the female has been found, a pit is dug in the path leading to the water and concealed by boughs. As the mother comes down the path, the calf just in front crashes into the trap. The mother is terrified. Any visible foe she would charge, but the mystery of this sudden disappearance puts her to flight.

Rhinoceroses are seldom seen in herds; generally they are found singly or in pairs. They are no longer common for they do not increase rapidly and have been much hunted. A calf is born at long intervals and they are not long-lived animals. The oldest by actual known record was an Indian rhinoceros that lived for 40 years in a London zoölogical garden.

LITTLE RHODE ISLAND *and Its* BIG MILLS

Extent.—North to south, 48 miles; east to west, 36 miles. Area, 1,248 square miles. Population (1920 census), 604,397.

Physical Features.—Low hilly country; Atlantic Ocean on the south; Narragansett Bay extending 28 miles inland in the southeast. Principal rivers: Providence and its tributaries, the Blackstone and Pawtuxet, emptying into the bay; Pawcatuck, into the Atlantic.

Products.—Hay, corn, oats, potatoes, and truck vegetables, fruit; cattle and dairy products; oysters, lobsters, clams, etc.; textiles (woolens, cotton goods, silks, hosiery, and knit goods); jewelry, silverware and plated ware, iron and steel manufactures, electrical goods, food products.

Chief Cities.—Providence (capital, 240,000), Pawtucket (65,000), Woonsocket (45,000), Newport (32,000), Cranston (30,000).

RHODE ISLAND. Scores of huge many-windowed cotton and woolen mills, with their thousands of humming spindles and roaring looms—that is the picture of Rhode Island that lingers with visitors.

Have you ever seen the inside of a modern cotton factory? Try to imagine one of the operatives or even one of the foremen going to Greenland or to South Africa and trying to set up a cotton factory from memory—drawing patterns of all those beaters, cards, "mules," and whirling spindles, getting unskilled workmen to make them, even making many himself, and then teaching people who had scarcely dreamed of machines before how to run them.

You will then have a picture of the task of Samuel Slater when he came from England to Rhode Island, in 1790, to start a cotton spinning mill at Pawtucket. Of course his machines were simpler, and were run directly by a water wheel instead of by electricity; and he had been to some extent an inventor as well as a workman in Arkwright and Strutt's great pioneer factory back in England. But nevertheless a year passed before he had overcome the first mistakes and had accomplished the feat which others had tried and failed to accomplish. Owing to the strict secrecy preserved in England concerning the new spinning inventions, Slater had been unable to bring with him so much as a rough sketch; and indeed he had to dress as much like a farmer as possible, instead of like a mechanic, in order to leave the country at all. But by the end of 1790 he had his factory completed, and was producing a cotton yarn as fine as any spun in England.

From that first factory set up at Pawtucket by Samuel Slater have come the many textile mills that make this smallest of American states (only about three times the size of Greater New York City) one of the greatest manufacturing centers and the most densely populated of the United States.

In recent years the woolen and worsted industry has outstripped cotton, in which it now ranks fifth. Rhode Island also ranks high in silk and silk goods. Rhode Island's population is 96 per cent urban, and it is greater than that of Arizona, Idaho, Montana, Nevada, New Mexico, Utah, or Wyoming—into any one of which states her area of 1,248 square miles would go from 65 to 118 times.

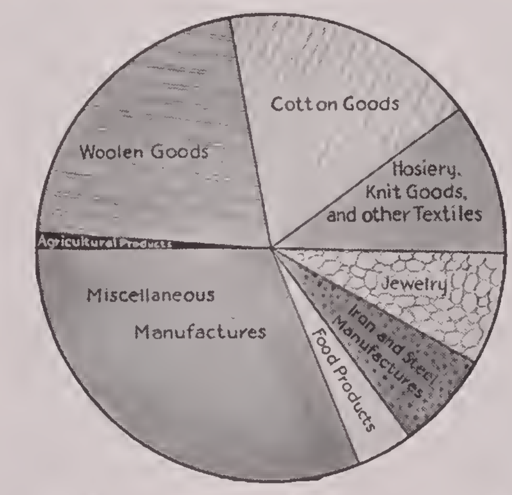
The geographical features of Rhode Island have contributed largely to the state's concentration upon manufacturing. The rough and hilly—but not mountainous—surface is unfavorable to agriculture, and her crops today are of little importance, although the market gardens around Providence are among the

HOW THE PAWTUCKET WORKS FOR PAWTUCKET

Placid as a mill pond is the section of the Pawtucket River at which we are looking, but further on it's as busy as a bee; for the power it provides when it plunges nearly fifty feet over a picturesque mass of rock runs some of the great mills for which the city of Pawtucket is famous. Above the falls it is generally known as the Blackstone River.

largest in the United States. The small but swift rivers, on the other hand, furnished the water power which gave the first impulse to manufacture; and now that coal has become more important than water, Rhode Island still has an advantage, for her position on the coast means cheap and abundant sea-borne coal.

Narragansett Bay, with its good ports at Providence and Newport, meant commercial importance from the first. At the time of the embargo of 1807 and 1809, however, when ships rotted at their wharves all along the Atlantic seacoast, the shipowners took thought of Samuel Slater's factory at Pawtucket, and many turned their commercial fortunes to manufacturing purposes.

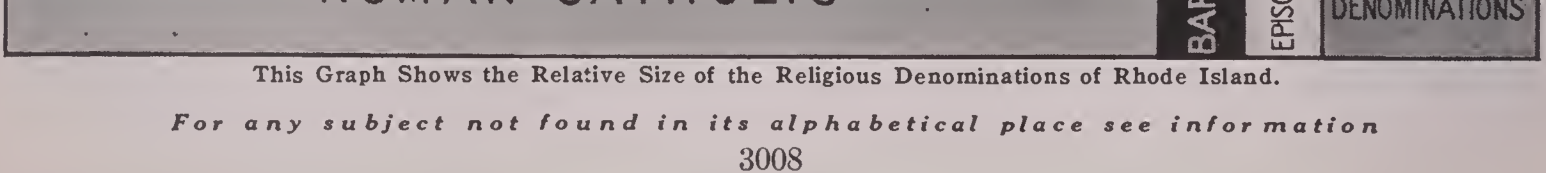


Here we see the relative value of the chief products of the state.

The seacoast with its ponds, islands, and indentations multiplies about 20 times the coastal length as the crow flies. With Block Island, lying well out to sea, this means today not only commerce but fisheries. The traffic in shell-fish—lobsters, oysters, and clams—along Narragansett Bay is particularly important, and Rhode Islanders maintain that their clambakes are the best in New England.

Imagine this busiest of modern industrial states, with its hordes of foreign immigrants, still governed largely by that typically colonial institution, the New England "town meeting." Every two years, when the governor and other state officers are elected, prosperous citizens and newly naturalized immigrants alike swarm by communities to their appointed central polling places. In local matters the towns are entirely governed by their town meetings. Fellow townsmen, as they get together to discuss things in meeting, and gather by groups outside when the meeting breaks up, or saunter away down the village main street by twos and threes, come to know each other unusually well.

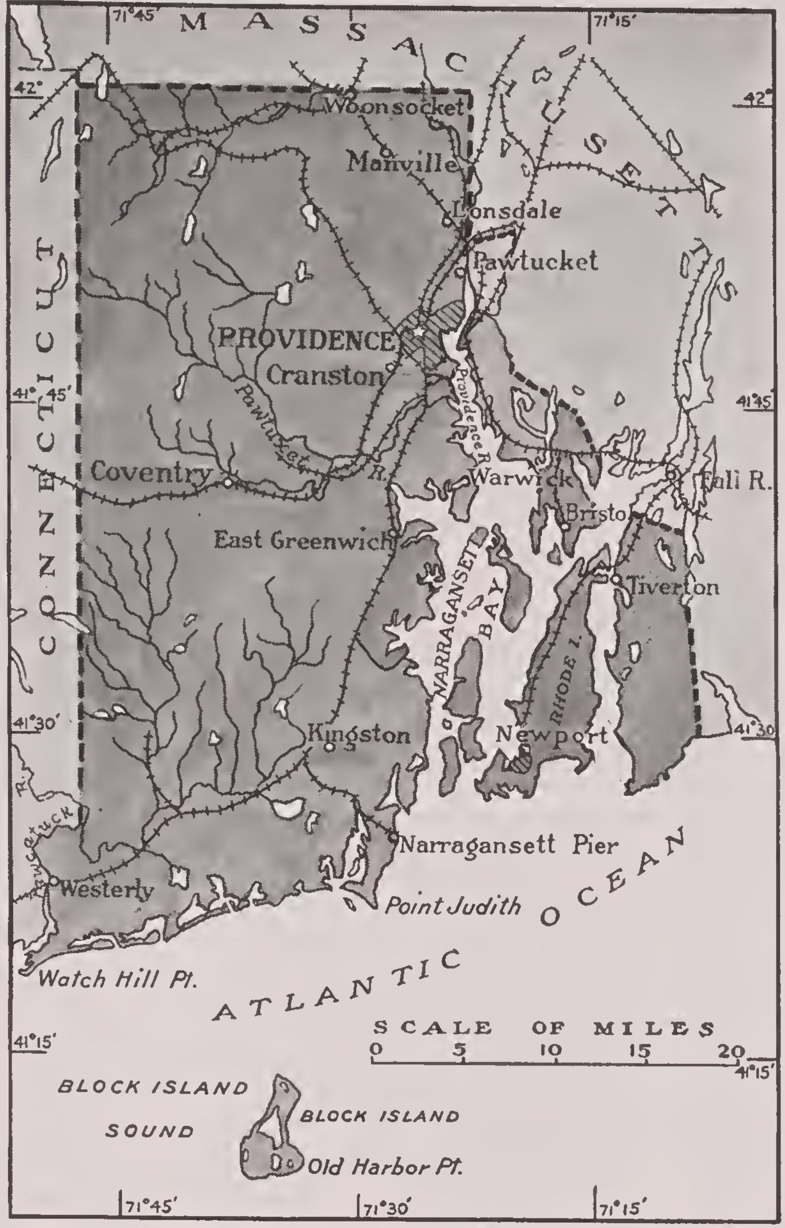
In the old colonial days, when Providence had only one street, the town meeting was held every two weeks, and between whiles leading citizens came together informally to discuss things in John Smith's mill. The town meeting, presided over by a moderator, vested in a small number of "selectmen" the power of "ordering and managing the prudential affairs of the town," and these selectmen in turn



This Graph Shows the Relative Size of the Religious Denominations of Rhode Island.

appointed special committees when necessary. The early towns were really little land corporations, and their sessions, at first taking the place even of the courts of law, have always held the local governmental power, notably in the raising of money for schools, poor relief and other necessary charges. It was discussion in town meetings that led Rhode Island, although first to declare independence, on May 4, 1776, to reject the Federal Constitution at first, and ratify it last of all the thirteen states (May 29, 1790), more than a year after that government had gone into operation. In 1832 Providence found the town meeting inadequate as its sole form of government and obtained a city charter. Once a year a town meeting is called to administer one of the funds, although it is said to be hard to get the quorum of 40 necessary for the task.

THE SMALLEST OF THE STATES



But size, say the Rhode Islanders, isn't everything. Their state is one of the richest and most densely populated regions in America.

Although Massachusetts was founded to escape religious persecution in England, Rhode Island was the first colony that really achieved unrestricted religious liberty. Its first settlement, then called "Providence Plantations," was founded by Roger Williams, a religious refugee from Massachusetts, in 1636 (*see* Williams, Roger). The charter granted Roger Williams in 1643 by Oliver Cromwell and Parliament made "Rhode Island and Providence Plantations" a haven for all sorts of religious refugees, who here found that freedom to worship God which elsewhere they sought in vain. The later charter of 1663 was the most liberal granted in the colonial period and was so satisfactory that Rhode Island existed under it for nearly 70 years after the American Revolution. This charter gave suffrage only to men owning $134 worth of property, or to their eldest sons. This provision was not oppressive so long as all families owned land, but by 1840 a discontented propertyless class had arisen. In 1841, under the leadership of Thomas Wilson Dorr, the malcontents held a constitutional convention, drew up a new constitution based on the principle of universal manhood suffrage, and elected state officials under this consti-

This is the Capitol of Rhode Island, the prosperous little commonwealth affectionately known to its people as "Little Rhody." The Capitol is the finest building in Providence. It is built of Georgia marble and white granite. In the State Chamber is a famous full length portrait of Washington by Gilbert Stuart.

THE SUMMER PLAYGROUND OF AMERICA'S MILLIONAIRES

The Cliff Walk at Newport winds along the eastern shore of the island of Rhode Island—from which the State gets its name—for a distance of three miles. Back of it lie the magnificent summer residences which have made Newport world famous. If you should happen to be surf-bathing at Bailey's Beach just south of this walk, with a stiff southeaster blowing, you might think you saw a gigantic whale spouting. For nearby is the Spouting Rock, which has an opening through which the water sometimes spouts up to a height of fifty feet when there is a gale from the right quarter.

tution. The old governing class, becoming alarmed, also held a constitutional convention and drew up a new constitution making many concessions. The rebels refused to withdraw their own constitution and government until Federal troops were called in and arrested Dorr as a traitor. He was sentenced to life imprisonment, but pardoned by the first legislature under the new constitution.

Even today the Rhode Island constitution contains many distinctive features. Each town or city has one member in the state senate, regardless of its population, just as New Hampshire, Vermont, and Rhode Island, small as they are, each have two senators in the United States Senate. In the lower house each town or city has at least one member, but no town or city may have more than one-fourth the total number. Thus Providence, which has one-half the population of the state, has one-fourth of the total representation for the House.

Rhode Island claims to have performed the first overt act and to have shed the first British blood in the American Revolution when, in 1772, citizens of Providence burned the British armed cutter *Gaspee* which had been enforcing the revenue laws. During the war, America's French allies used Newport for their headquarters, and inaugurated the atmosphere of social gaiety that prevails to the present day in that fashionable summer-time play center for the millionaires of the country.

Before the Revolution Newport (which lies on the island on Narragansett Bay from which the state gets its name), was an important industrial city; its commerce was greater than that of New York in 1869–70. But today it is chiefly famous as a summer resort, with its long line of costly summer residences stretching along the 12-mile Ocean Drive. The narrow streets and quaint old houses of the older part of town around the harbor contrast strikingly with the magnificent new homes of the summer colony. Other important cities, aside from Providence, are Pawtucket, which is practically a continuation of Providence, and Woonsocket—both famous for their cotton and woolen mills and other industries. (*See* Providence.)

RHODES. This easternmost of the Aegean islands, ten miles from the coast of Asia Minor, took its name—so it is said—from the rose (Greek *rhodes*), which is one of the commonest emblems of the sun-god Helios, by whom the island was particularly favored. The climate is delightful and in addition to roses its fertile soil fosters vines and olive trees, figs, pomegranates, and oranges, as well as all kinds of grain. Myrtles, oleanders, and cactus grow along the mountain streams.

It was to the patron god Helios that the Colossus of Rhodes, one of the seven wonders of the ancient world, was erected in 280 B.C., at the mouth of the fine double harbor of the city of Rhodes. This statue, made of plates of bronze, was 105 feet high and cost 300 talents (about $360,000). Long after it had been overthrown by an earthquake (in 224 B.C.) it remained even in fragments an object of wonder to the ancient world. So vast was it that when a Saracen dealer removed the fragments for old metal (in A. D. 656) he required 900 camels to carry his purchase away.

Although only 45 miles long by 22 broad, Rhodes was a maritime power of importance during all the centuries from 500 B.C. down to the Christian era. Even in Roman times it remained famous for its schools of art and oratory, Apollonius Molon, the teacher of Cicero, being a Rhodian. From A.D. 1309 until 1523, the island was in the hands of the Knights Hospitalers of St. John, and the principal street of the capital is still called the Street of the Knights and retains its old houses with their armorial bearings. In 1522, after 40 years of successful resistance, Rhodes fell into the hands of the Turks, who held it until the World War of 1914–18. Today the island, with its capital (now called Kastro), is becoming a trading center for the Aegean and Asia Minor, and steamers stop there regularly. Excavations of ancient sites have been of interest not so much for the ruins themselves, which have been much scattered by earthquakes, as for examples of pottery and other antiquities.

RHODES, CECIL JOHN (1853–1902). While making a solitary eight months' journey over the rolling "veld" of that part of South Africa which now bears his name—Rhodesia—Cecil Rhodes dreamed the dream which shaped all his future life. He was only 20 years of age at the time and had already won a fortune in the diamond fields of Kimberley.

CECIL RHODES
"A Builder of Empire"

A passionate believer in the destiny of the Anglo-Saxon race, Rhodes was impressed by the boundless possibilities of this undeveloped country and became fired with an ambition to "paint as much as possible of South Africa British red"—that is, to bring it into the British Empire. His dream did not stop there. He saw a vision of the English-speaking world—the United States and Great Britain with her far-flung colonies—welded together into an irresistible instrument to advance civilization and insure perpetual peace.

To this stupendous task all of Rhodes' energies were thenceforth devoted. He had the satisfaction of seeing part of his dream realized. He added 700,000 square miles of territory to the British Empire, and planned the Cape-to-Cairo railway to connect the Cape of Good Hope with the mouth of the river Nile. He did not live to see the federation of the states of South Africa, or to see the Anglo-Saxon peoples pour out their blood in a common flood to end the menace of German military autocracy.

Rhodes was born July 5, 1853, in the vicarage of a country parish, England. At 17, heart trouble forced him to give up his plan to go to Oxford University. He joined a brother in South Africa just in time to join the rush to the newly discovered diamond fields, equipped with bucket and spade and several volumes of the Greek classics. Within a few months he had made a fortune. His head was not turned, as would have been the case with many a boy, nor did he feel that he was beyond the need of further schooling.

This vigorous life so improved his health that he was able to take up his work at Oxford. For eight years he alternated between the University and South Africa. In 1881, just before taking his degree, he was elected to the parliament of Cape Colony, and in 1890 he became its prime minister.

Rhodes was then virtually dictator of South Africa. Few men in modern times have wielded such power. In addition to his political power, through his vast business interests he controlled the great consolidated diamond and gold mining interests of the country, and was managing director of the gigantic British South Africa Company, which he had formed to develop the territory that so struck his youthful imagination. Disaster came six years later, in connection with the ill-fated raid of Dr. L. S. Jameson in aid of a revolution to overthrow the backward Boer government in the independent Transvaal Republic. Cecil Rhodes was forced to resign the premiership and give up control of the South Africa company because it was proved that he had aided this movement.

One of the most picturesque incidents in Rhodes' colorful career came a few months later, when the Matabele natives revolted. Attempts to suppress the rebellion proved futile. Rhodes pitched camp, unprotected, at the foot of the impregnable Matoppo hills where the natives had retreated, and patiently waited. His courage so amazed the chiefs that they started coming in for parleys. Finally a conference was arranged in the fastnesses of the hills. Rhodes and three companions rode unarmed into the midst of the chiefs, heard their grievances, promised redress, and the rebellion was over. He re-entered the Cape Parliament in 1898 and had made some progress toward regaining his old power when the Boer War (1899–1902) began.

Upon the outbreak of the conflict, Cecil Rhodes hastened to Kimberley, where he took an active part in defense of the town and mines. Privations and incessant labor during the siege broke his health, and he died March 26, 1902. He was buried, as he desired, in a tomb hewn in the granite of the Matoppo hills.

Always a great reader, Rhodes once said that his life had been more influenced by one sentence of Aristotle than by almost anything else. In his own paraphrase, the sentence is this: "The greatest happiness in life is to be derived from the conscious pursuit of a great purpose."

Rhodes bequeathed the bulk of his huge fortune for the endowment of about 175 scholarships at the University of Oxford, to be held for three years each by selected students from every important British colony and from the United States. Fifteen scholarships were also allotted to Germany, but these were cancelled during the World War of 1914–18. Each scholarship yields £300 a year (normally about $1,500).

In the United States two scholarships are assigned to each state; hence elections are held in two years out of every three. Candidates must be male citizens of the United States, unmarried, between 19 and 25, and must have completed at least the sophomore year at some recognized degree-granting university or college. They may apply either from their home states or from any state in which they have received at least two years of their college education. Each college or university is entitled to appoint from one to four candidates to compete for the appointment. From these the state committees of selection, which usually consist of former Rhodes Scholars, make the final selection, on the basis of: (1) qualities of manhood, force of character, and leadership; (2) literary and scholastic ability and attainments; (3) physical vigor, as shown by interest in outdoor sports or in other ways. The qualifying examination formerly required of all candidates has been abandoned. Those appointed to scholarships may elect any course of study at Oxford for which they are qualified by their training.

RHODODEN'DRON. Throughout June and July the gorgeous blossoms of these broad-leaved shrubs and small trees beautify the mountain slopes of eastern North America, growing in thickets along the lonely roads, on the steep banks of streams, or on the heights, where their bright blooms and shining foliage mingle with the somber leaves of the forest trees. Some have carmine, others lilac-colored or purple flowers. Besides the species native to North America and Europe there are many others found in Asia, especially in the Himalayas, Borneo, and Java. The rhododendrons are cultivated extensively and with great success as garden shrubs, many of the hybrid forms developing more beautiful and conspicuous flowers than do the native species, without losing their natural hardiness. The plants flourish in a moist but well-drained soil, preferably of the nature of vegetable mold. The wood is hard and heavy and is sometimes used in the manufacture of tool handles. The rhododendrons are akin to the azaleas.

Scientific name of the American or great rhododendron, *Rhododendron maximum.* Flowers rose-pink, varying to white, greenish in throat and spotted with yellow and orange; grow in clusters from conelike bud. Leaves evergreen, drooping in winter, lance-shaped or oblong, dark green. Sometimes a tree of 40 to 60 feet in height, more usually a shrub of 20 feet.

RHONE RIVER. Since the earliest days of civilization this picturesque stream which enters the Mediterranean near Marseilles in France has been one of the principal avenues of commerce leading from the Mediterranean across what is now France to the Rhine on the one side and to the coasts of the North Sea on the other. Phoenician traders received the tin of Britain by this route; the Romans made of it the avenue of Caesar's conquests; Saracen bandits, crusades, and commerce poured along this way in the Middle Ages; and today its long strip of navigable waters and the canals which connect it with the Loire, the Seine, and the Rhine make it one of the great water routes of Europe.

Springing as a torrent from the foot of a great glacier high in the Alps of southern Switzerland (nearly 6,000 feet above sea level), and swollen by many mountain streams, the Rhone dashes down through wild gorges and flows southwestward through the broad beautiful valley between the Bernese Alps (north) and the towering Pennines (south). Picturesque old villages and thriving little towns cluster along its banks, and in the distance Great St. Bernard and the Matterhorn look down upon it from a dizzy height, as it rushes swiftly through this beautiful mountain region. At Martigny, 75 miles from its source, the river turns sharply to the northwest and, flowing through a wide marshy plain, pours into the Lake of Geneva. There it leaves all the impurities gathered in its turbulent course through the mountains, and issues from the southwestern extremity of the lake limpid and clear as crystal. But half a mile below Geneva the Arve River that descends from the glaciers of the Mont Blanc range pours its turbid waters into the Rhone. Twelve miles west of Geneva the Rhone enters French territory and rushes through narrow gorges around the southern spur of the Jura Mountains, receives from the north the waters of the Ain, and then flows freely westward to Lyons. Thus far a huge and unruly mountain torrent, it there receives the Saône, its principal tributary, and turning southward becomes one of the great historic rivers of France, flowing through a land of romance and poetry, of vine and olive, and of old Roman temples and papal palaces. Between Lyons and the sea, a distance of 230 miles, the steep slopes above the river are everywhere covered with rich vineyards. Along its left bank lie such historic cities as Vienne, Valence, Avignon, Tarascon, and Arles, and on that side the Isère, the Drome, and the Durance rivers, bringing down the melted snows from the lofty Dauphiné Alps, add to it their waters. On the right the Ardèche is the only important tributary. About 25 miles from the Mediterranean the Rhone divides into two main branches—the Grand Rhone running southeast and the Petit Rhone southwest—and thus discharges its waters into the sea.

The total length of the Rhone is a little more than 500 miles, of which Lake Geneva claims 45. The headwaters of the Saône, which rises in the Vosges Mountains in northeastern France and flows 301 miles southward to meet the Rhone, might well be considered, both geographically and from a commercial point of view, as the headwaters of the latter stream, for its course is much more direct than that of the upper Rhone. It is by means of canals branching off from the course of the Saône that the Rhone communicates with the basins of the Loire, the Seine, the Rhine, and the Moselle. Plans are under way for the utilization of the waters of the Rhone and its tributaries to generate electric power on a large scale for the operation of the railways and industrial plants of southeastern France.

RHUBARB. Pie and the acid fruit-flavored sauce made from the long juicy leaf-stalks of the rhubarb or "pieplant" are among the earliest gifts of the garden in the spring. When a few rhubarb roots have been set out in the garden, practically no more attention need be given the bed, for it will renew itself year after year and the stalks are simply pulled from the low crown of the plant as needed. Rhubarb requires a rich soil, however, and the wise gardener will force early growth by putting fertilizer around the roots in the spring. Placing an old bushel basket, half barrel, or other cover over the plants causes the leaves to shoot up rapidly in search of light and thus produces longer stems that are especially succulent and tender.

Rhubarb is a member of the dock family, and has large heart-shaped leaves, sometimes a foot across. Cultivation has greatly improved the plant, making the stems less woody, with thinner skin and better flavor than the stems of the wild plant. In spring the skin is flushed with red that adds attractive coloring to the light green sauce. Scientific name, *Rheum rhaponticum.* The roots of certain species are sometimes employed in medicine for their cathartic and tonic properties.

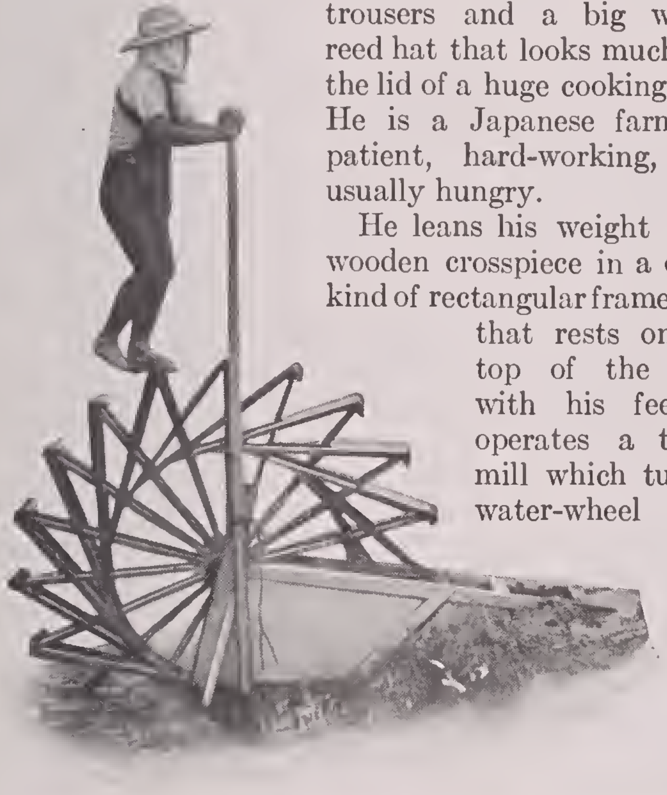
The RICE PLANT *and the* PADDY FIELDS

The Little Mud-Pie Farms of Oriental Lands—The Sowing, Cultivation, Harvesting, and Threshing of the White Grains that Feed Millions, All around the World

RICE. It is a hot sultry day in faraway Japan, exactly the sort of weather that suits the moisture-loving rice plant. On the top of a little mud wall around a small field stands a thin yellow-skinned man, clad only in black cotton trousers and a big woven reed hat that looks much like the lid of a huge cooking pan. He is a Japanese farmer—patient, hard-working, and usually hungry.

He leans his weight on a wooden crosspiece in a queer kind of rectangular framework that rests on the top of the wall; with his feet he operates a treadmill which turns a water-wheel with little cups or paddles set in its circumference. This raises the water from the ditch below and spills it into the field, which looks just now much like a big mud-pie.

"MAN POWER"



Here and there in the rice fields of Japan and China you will see men at work like squirrels in a cage, patiently turning wheels that lift water into the rice fields.

Tomorrow the tiny rice plants will be transplanted into this "paddy" field which is being made ready so carefully. Three or four weeks ago the seed was sown broadcast in a smaller muddy field, much like this one, and then covered with water.

Very early next morning the whole family arrives—father, mother, the older children, and perhaps some outside helpers, three or four chubby little roundfaced babies, and grandpapa, who has come along for an outing. Barefooted and with trousers rolled to the knees, all but the babies and grandpapa wade into the oozy mud and begin setting out the young plants in rows about 18 inches apart. The last part of the day's task is to flood the field, for growing rice prefers to spend most of its life in the water. That is the reason the fields must always be walled. Before long this little plot, covering not more than two or three acres at most, would remind you of a field of young oats, if you didn't catch the gleam of the water in between the stems.

Then the Weeding, More Watering, the Harvest

Hot wet weather makes weeds also grow rapidly. Sometimes the natives wade into the water and pluck out the weeds with their toes as neatly as you could with your hands; but usually each time weeding is needed the field is drained.

Then there's more work at the treadmill, until there is again enough water in the field to float the leaves. When the leaves begin to change from green to yellow the water is drawn off for the last time. The grain then ripens rapidly in the sun. Some varieties mature in three months, others require from four to six.

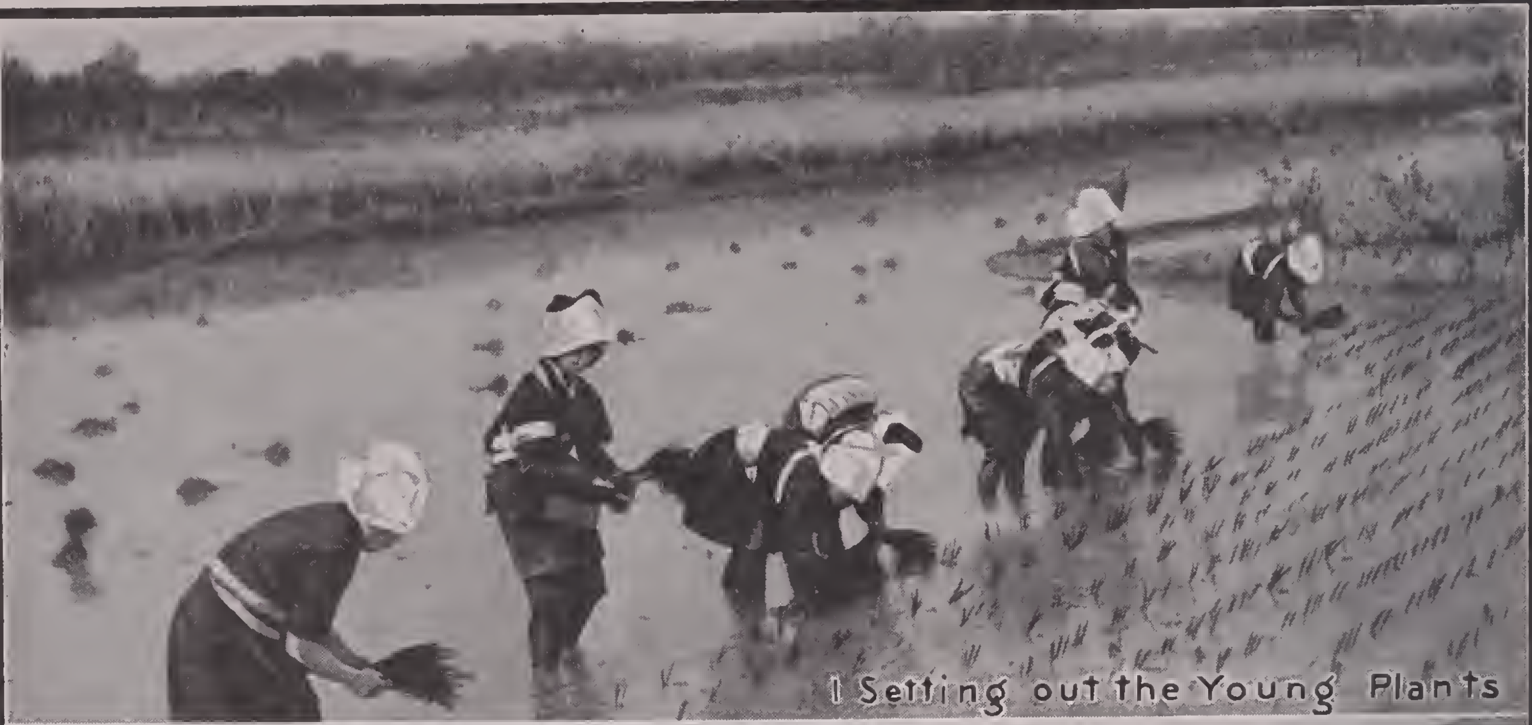
In Japan machinery has no part in the harvesting of this crop. The straws are cut with a hand-sickle, a handful at a time. Threshing is very simple, just pulling the heavily-laden heads through a saw-toothed frame placed over a tub or cask. The Japanese, who have learned to waste nothing, use the straw for making hats, sandals, matting, and bagging. The roots are burned and return to the field as fertilizer.

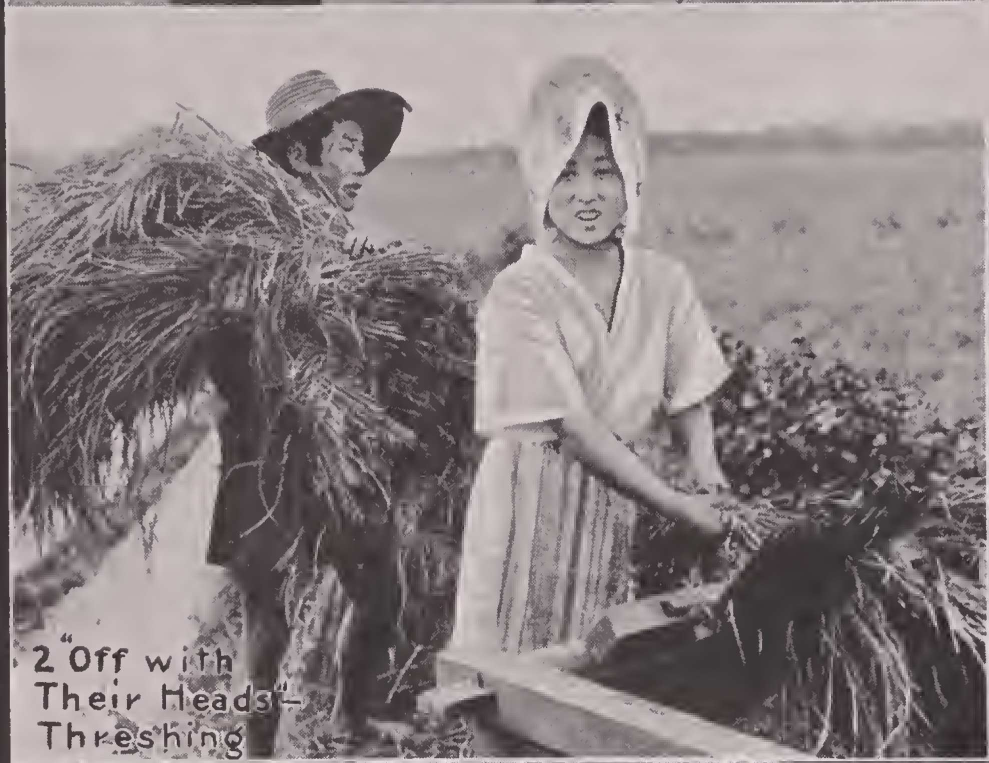
To get rid of the outer husk the grain is beaten with flails. The tight-fitting inner covering is then loosened in little hand-mills. For long hours at a time women and children squat on the ground shaking the mixed grain and chaff up and down and to and fro in shallow reed baskets, that the wind may blow the latter away.

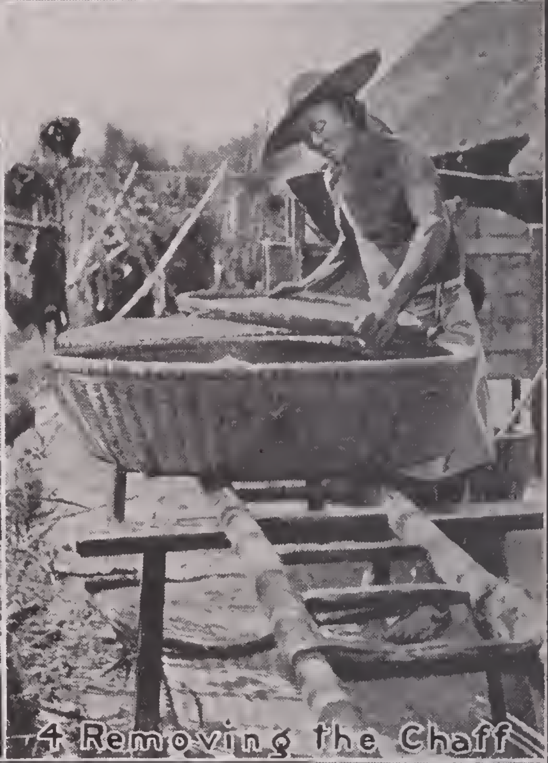
Rice Growing around the World

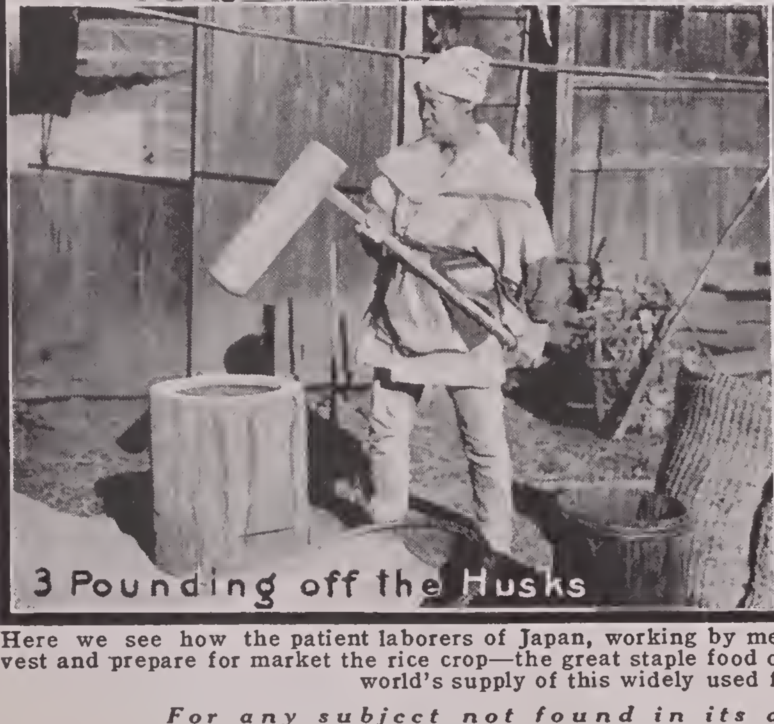
Rice, which furnishes the principal food of one-third of the world, is grown most profitably and easily on low river flats subject to frequent inundations which leave behind them a deposit of rich alluvial soil. For that reason it is the main crop along the lower Yangtze in China, the lower Ganges in India, the

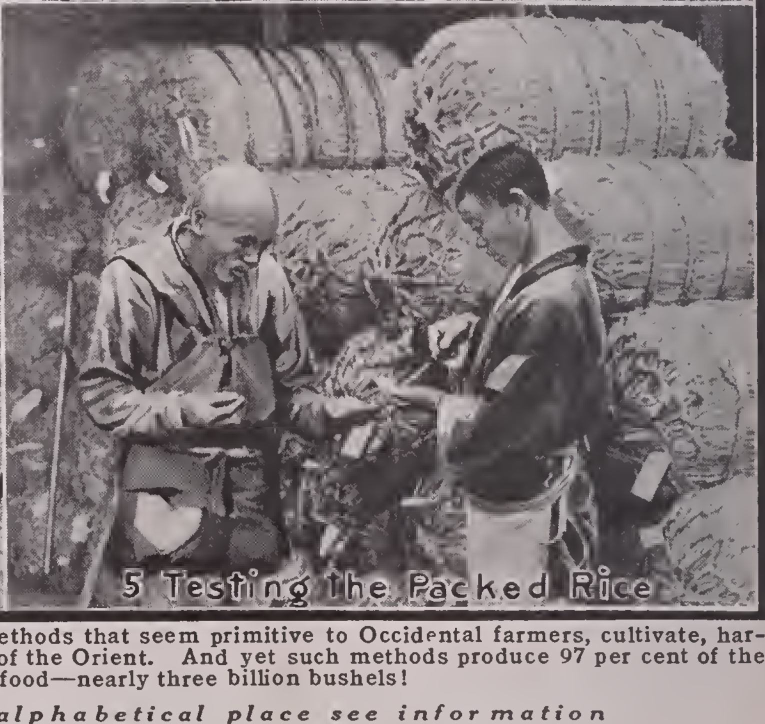
THE PICTURE STORY OF A GRAIN OF RICE


1 Setting out the Young Plants


2 "Off with Their Heads"—Threshing


4 Removing the Chaff


3 Pounding off the Husks


5 Testing the Packed Rice

Here we see how the patient laborers of Japan, working by methods that seem primitive to Occidental farmers, cultivate, harvest and prepare for market the rice crop—the great staple food of the Orient. And yet such methods produce 97 per cent of the world's supply of this widely used food—nearly three billion bushels!

delta of the Irrawaddy in Burma, in Siam and French Indo-China, and on the banks of the Egyptian Nile. All these districts possess also the other requisite of successful rice-growing, a long warm growing season.

But in most of the countries of Asia there are so many mouths to feed that every available foot of land, no matter how inaccessible or how difficult of irrigation, must be utilized. Rice is often grown on steep mountain slopes where it is possible to irrigate the crop. Impossible-looking mountainsides are leveled into little terraces like shelves, and the water dropped in ditches from one level to another until outcropping rock or sheer cliffs block the way.

In India, Burma, the Philippines, and the Malay Peninsula, the work of preparing the soil is a little easier. The humpy pig-skinned water buffaloes drag the plow over the fields, or travel all day long in a circle supplying power for a pump that is at least one step in advance of the Japanese treadmill. The Indian plow is more often than not a crooked stick which only scratches the surface; but the Burmese farmer usually has a wooden plow and harrow. How different these processes are from the reaping machines and steam threshers used in most parts of the United States in which rice is grown!

But the cultivators of the Orient raise 97 per cent of the world's supply—nearly three billion bushels! India, China, Japan, Siam, the Philippines, Egypt, and the United States are the principal producers. Before the Civil War, Georgia and the Carolinas were the only states in which rice was a product of any importance. In 1900 Louisiana was producing 80 per cent of the American crop and she still leads the list, with Texas, Arkansas, and California close behind.

Rice (*Oryza sativa*) is one of the most important of the cereal grasses (*see* Grasses). As a food, rice is more like potatoes than wheat, for it is three-fourths starch. In the brown skin that is polished away in the milling process there are valuable mineral salts and substances called vitamins, without which a diet chiefly of rice often produces a disease called "beri-beri." Fortunately the peoples of the Orient, who live chiefly on rice, do not as a rule use polished rice. A large proportion of the rice brought to Europe is made into starch. Some of it is used by distillers of alcohol. The national drink of Japan, called *saké*, is prepared from rice by fermentation.

ENGLAND'S RICHARDS, *Good and Bad*

The Lion-Hearted King who Led the Third Crusade—The Passionate and Lawless Tyrant who was Deposed by His Subjects—The Black-Hearted Monster who Gained a Crown by Murder

RICHARD, KINGS OF ENGLAND. It would be hard to find more widely contrasting types than the three Richards who have sat on the English throne.

RICHARD I, called the Lion-Hearted (*Coeur de Lion*), who ruled from 1189 to 1199, was more than six feet in height and fair-haired and blue-eyed. As his nickname shows, he was a splendid fighter, the greatest of his day. He was a poet also, and men loved to hear him sing; but as a king he was too careless of his duties to be called a great ruler.

Richard grew up wholly under French rather than English influences. Both his parents, the energetic Henry II and the forceful and passionate Eleanor of Aquitaine, were of French birth and education. His father was the first Plantagenet king of England, but his possessions in France were greater than all England. French was the language of the Plantagenet court, where gay troubadours and minstrels were always welcome. French was Richard's native tongue, and almost all his life was spent in France; even after he became king he made only two brief visits to England.

At the age of 15 Richard was formally placed in charge of his mother's duchy of Aquitaine, in southern France. Next year he joined his brothers, aided by the French king, in a widespread but unsuccessful revolt against their father (1173). He also engaged in struggles with his elder brother Henry and his younger brother John. The death of his brother Henry (1183) made Richard the next heir to the throne to which he succeeded on the death of his father in 1189.

News of the recapture of Jerusalem by the Mohammedans, two years before, had stirred all Europe, and great preparations for the Third Crusade were already on foot. For Richard this proved the great undertaking of his life. After a brief visit to England, to be crowned and to provide for the raising of money for the government in his absence, Richard returned to the Continent to complete his preparations. The English fleet sailed by way of Gibraltar to Marseilles, while Richard journeyed overland to the same port. He joined King Philip of France at Sicily, where they wintered and quarreled violently. Richard again turned aside on the way to the Holy Land to fight with the ruler of Cyprus. He finally joined Philip at the siege of Acre, which surrendered in July 1191.

Because of his military skill and courage, Richard was soon acknowledged as chief leader of the crusade. King Philip shortly returned to France, to plot against his rival. For more than a year Richard remained in Palestine. When he fell ill of fever it is said that his great opponent, Saladin, the chivalrous leader of the Mohammedans, sent him fruit and snow. "He was brave," says an Arab writer, "experienced in war, and fearless of death. If he had been alone among millions of enemies, he would not have declined battle; when he attacked there was no resisting." Twice the crusaders were within two days' march of Jerusalem, but were unable to take that holy city. At last Richard negotiated a truce for three years, under which the Christians might safely visit the Holy Sepulcher; and then sailed for home, in October 1192.

King Philip and Richard's brother John were plotting desperately against him, and when Richard was forced to land at the head of the Adriatic Sea he found himself a hunted man. In the disguise of a merchant he reached Vienna, the home of his worst enemy, Leopold, Duke of Austria. When detected, he was arrested and imprisoned. A beautiful story tells how his minstrel Blondel discovered his whereabouts by singing under the windows of many castles until he heard the imprisoned Richard's reply.

Money for Richard's ransom was finally raised and he was released in February 1194. Hastening to England, he found John's attempted revolt already crushed. John himself was forgiven. The remaining five years of Richard's reign were spent in constant fighting with Philip, and building with great engineering skill his "Saucy Castle," the Chateau Gaillard in Normandy. The government of England was left chiefly to administrators trained by his father, Henry II. Richard died as he had lived, fighting. While besieging a castle in southern France, he was wounded by a cross-bow bolt in the shoulder, and died in consequence a few days later. Even during his lifetime Richard's deeds were the subject of song and story. In later times they have been treated by Sir Walter Scott in his novels 'Ivanhoe' and 'The Talisman'. A truer picture of Richard is given by Maurice Hewlett in his novel 'Richard Yea and Nay'.

The Temperamental Richard II

RICHARD II (1377–1399) was the son of the "Black Prince," who fought so courageously at Crécy and Poitiers in the reign of Edward III. The death of his grandfather Edward III, following that of the Black Prince the year before, made Richard king when he was only a boy of ten. His character and his reign were full of contrasts. At one time he faced a mob with courage and coolness; at another he would give way to furious fits of passion, throwing his hat and boots out of the window or slapping the face of the archbishop of Canterbury. At one period he ruled with great moderation and won popularity; at the end of his reign he threw moderation to the winds, and ruled so tyrannically that he was deposed.

During the minority of Richard there were quarrels between the great nobles who struggled for power and there were religious dissensions growing out of the teachings of John Wyclif (*see* Wyclif, John). There was also a formidable Peasants' Revolt in 1381, in which, according to one account, the 14-year-old king rode boldly forth to confront the angry rebels, when they found themselves betrayed and their leader slain, crying: "What need you, my masters? Would you shoot your king? I will be your captain." (*See* Tyler, Wat.)

It would take too long to tell in detail the story of the political struggles which filled the remainder of Richard's reign—of how Parliament appointed a commission to guide the king's rule; how the judges declared that the leaders of Parliament had committed treason; how those leaders raised an army and defeated the king's forces, and the "Merciless Parliament" then hanged or exiled the king's friends; how the king suddenly declared himself of age, ruled wisely for eight years, and then suddenly changed and put to death or banished his worst enemies; and how he surrounded Parliament with his archers and compelled it to grant him greater powers than any other English king had ever had.

This triumph but paved the way for his downfall. Richard's cousin, Henry of Bolingbroke, son of John of Gaunt, Duke of Lancaster, was one of the opponents whom Richard had banished. In 1399 he returned to England with a few followers to recover his inheritance, which Richard had unjustly seized. His followers rapidly became an army and Richard II was forced by Parliament to resign the crown, which was then conferred upon Henry of Bolingbroke, the first of the Lancastrian kings (*see* Henry, Kings of England). The deposed king was kept for a time in London Tower, and then removed to the castle of Pontefract, in Yorkshire. When a rebellion broke out in his favor, in January 1400, Richard was murdered in his prison, though it was given out that he had died a natural death.

The Crimes of Richard III

RICHARD III (1483–1485) was a Yorkist prince who was so ruthless and unscrupulous that his character is painted in the blackest of hues. In after times Shakespeare in his 'Richard III' represented him as physically crook-backed and morally a monster. It is true that Richard's left arm was withered, but he was of average height and build, with the left shoulder slightly lower than his right, nor was he bad looking. He was well knit and more than a match in battle for many a man taller and heavier than himself. He grew up, however, in the midst of the civil strife which preceded the bloody Wars of the Roses, and at a time when the tyrants of Renaissance Italy were setting examples of government by intrigue, poison, and assassination. While naturally calculating and distrustful, Richard could be very engaging. He was able and hardworking, but his merits, such as they were, have largely been forgotten because of the way he won his crown.

When his brother, Edward IV, died, Richard of Gloucester (as he was then called) saw a chance to win the throne. Already he was suspected of murdering the Lancastrian Henry VI and the latter's son to secure the crown for Edward IV. Suspicion also pointed to him as the slayer of his brother the Duke of Clarence. Now there stood between Richard and the throne only the two little sons of Edward IV, the eldest of whom, Edward V, was not 13 years old. Richard secured control of both boys and had himself declared Protector by the council. He then spread charges that the late king's marriage had been illegal and that his sons therefore had no right to rule. A packed assembly summoned in place of the regular Parliament thereupon asked him in 1483 to take the crown as Richard III.

Installed as king, Richard III sought to make himself popular, but it was noted that those who stood in his way were soon got rid of. First it was Lord Hastings, an old officer of Edward IV's, who was accused of plotting and instantly executed. Then the two uncles of the little princes, brothers of their mother, were put to death on charges of treason. Finally the two little princes themselves, whom Richard had imprisoned in the Tower of London, disappeared, and it was rumored that they were murdered. Twenty years later one of Richard's agents confessed that he had caused them to be strangled; and in 1674 two skeletons corresponding in size to the little princes were found secretly buried in the Tower.

The disappearance of these two young princes turned the great mass of Richard's subjects against him. For two years he maintained himself upon the throne, but he lived in uneasy fear, and his hand was always on his dagger when he rode abroad. An uprising headed by the Duke of Buckingham failed, and that leader also perished on the scaffold.

Then in 1485 Henry Tudor, Earl of Richmond, who as the last male representative of the Lancastrians had a claim to the throne, prepared an expedition in France which landed in the west of England and rallied supporters to him. Richard advanced to meet the invader at Bosworth Field. Although a portion of his troops withdrew or went over directly to the enemy, Richard fought with terrific courage. Deserted, and surrounded by his enemies, he struggled on until he fell pierced with wound upon wound. That same day the victorious Tudor was crowned Henry VII, with Richard's battered crown, picked up from the battlefield. (*See* Edward, Kings of England; Henry, Kings of England.

RICHARD'S FIRST VIEW OF THE HOLY LAND

With his famous sword raised in an attitude of consecration, Richard of the Lion Heart is here looking for the first time across the plain to the Holy Land, where he performed such prodigies of reckless valor.

RICHELIEU (*rēsh'ē-lṳ*), CARDINAL (1585–1642). No more striking figure can be found in all the dramatic history of France than that of Armand Jean du Plessis, Duke of Richelieu, who, as a cardinal of the Catholic church and chief minister of state, controlled for nearly 20 years the destinies of France and raised her to the position of the foremost power in Europe. Haughty, stern, ruthless, implacable, the great Cardinal is a figure that kindles the imagination and has been the theme of countless paintings, dramas, and romances. Even when sickly and wasted with disease, such was the force of his will and the majesty of his bearing that he over-awed all, including the king. He loved the privileges and trappings of power, living in royal state, and forcing even princes to yield him place. Not even the most powerful noble in the realm dared to stand against him. Every whisper of plot or discontent was brought to him by his scores of spies, as well as all that was said and done in every salôn of Paris and in every court of Europe.

Through the influence of powerful friends Richelieu became a bishop at the age of 21, and a cardinal at 37. His attention to the affairs of a small bishopric, however, did not interfere with his watchful search for a larger field of endeavor. He was ambitious for political power and preference, and he did not disdain to fawn upon queen and courtier to gain his ends.

His ambition was realized in 1624, when he became chief minister of France. From that time until his death he was so completely master of France that he quite obscured the personality of the weak king, Louis XIII, whose chief claim to greatness lies in the fact that he kept his great minister in power regardless of personal dislike and court intrigues.

THE IRON CARDINAL AT THE SIEGE OF LA ROCHELLE

The inflexible resolution with which Richelieu carried out his designs is well exemplified by his stubborn siege of La Rochelle, the chief stronghold of the Huguenots. To take it, he had to cut off the town from aid by sea, by building the great stone mole you see in the picture, a mile long and guarded by a floating stockade. In spite of the desperate energy of their resistance and the aid of English troops, the people of La Rochelle had to capitulate after a year's siege in which they were reduced to eating even the straps of their sword belts.

When Richelieu entered the royal service he aimed, as he once told Louis, "to employ all my efforts and all the authority which it might please you to give me, to ruin the Huguenot party, to lay low the pride of the nobility, and to raise your renown among foreign nations to the point at which it ought to be."

What Richelieu set out to do, he accomplished. In 1628, after a year's siege, he took from the Huguenots the town of La Rochelle, their principal fortress. This marked the end of their political power, although they still retained freedom of worship and civil rights.

To humble the nobles was a more difficult task, but the ruins of many of the medieval castles throughout France testify to the thoroughness with which Richelieu carried out his work. All fortified places not necessary to repel invasion he ordered to be dismantled or destroyed. He also appointed royal officers to oversee the governors of the provinces and bring them under the control of the king.

Aids German Protestants

The opportunity to carry out his third design was furnished him by the religious and political wars of Germany. (*See* Thirty Years' War.) Although a staunch Catholic and a cardinal of the church, Richelieu did not hesitate to aid the Protestants of Germany in their struggle against Spain and the emperor, at first by furnishing their ally, Gustavus Adolphus of Sweden, with financial aid, and later by engaging actively in the conflict. By this policy France was, at the conclusion of peace in 1648, the foremost power in Europe. Especially she had added to her domains the territory Alsace, which later became one of the "lost provinces," restored to her by the World War of 1914–18.

Richelieu did not live to see the conclusion of the Thirty Years' War, but his work was ably carried on by his follower, the wily Mazarin. The war had cost France immensely in men and money, and when Richelieu died he was the most hated man in the country. Humiliated noble and tax-burdened peasant joined in bonfire celebrations of their release from the tyrannical minister, yet the French people now esteem him as one of the greatest of their rulers. "His fame," says one writer, "is cherished because he secured for France glory and power, and a foremost place among European nations."

Richelieu also made himself an imperishable place in the literary annals of France by fostering the great writers of his day, and by founding the French Academy. (*See also* Gustavus Adolphus, King of Sweden; Huguenots; Louis, Kings of France.)

RICHMOND, VA. Classical-minded Virginians used to call Richmond the "New Rome," because it was built on seven hills; and others, mindful of its historic associations and atmosphere of culture, referred to it as the "Boston of Virginia." Today these nicknames are out of date, because they give no idea of the hustling progressive trade center which Richmond has become within the past generation.

Situated on the James River, 90 miles from the sea, Richmond is a port of entry, and the capital of the state. Coastwise steamships dock in the heart of the business district. It is Virginia's chief manufacturing city, and an important commercial center and distributing point for the southeastern part of the state, and for the Carolinas and adjoining Southern states as well. It is the reserve city for Federal Reserve Bank District No. 5 which includes the District of Columbia, Maryland, Virginia, North Carolina, South Carolina, and part of West Virginia. Smoking- and chewing-tobacco, cigars, and cigarettes are the principal manufactured products. Richmond claims the largest cigar factory and the largest cigarette factory in the world. Iron and steel works (the Tredeger works, still operating, made cannon for the Confederacy), lumber and planing mills, box factories, foundries and machine shops, and saddle and harness factories are among the other manufacturing plants.

Relics of Historic Days

As the state capital since 1779, and the seat of the government of the Confederacy, Richmond has many relics of Virginia's storied past. Chief among these is St. John's Church (built in 1740), where in 1775 Patrick Henry's cry of "Liberty or Death!" fired the hearts of the Virginia Convention, assembled to hear the report of the first Continental Congress. In the heart of the city stands a large granite cross, marking the site where John Smith and Captain Newport, on the way to visit Chief Powhatan, left their birch canoes, in 1607. Just west of what is now Chimborazo Park is the site of the battlefield of Bloody Run, where in 1656 Chief Totapotamoy saved the white settlers by aiding them in their fight against western Indians. In the house which was once the home of Chief Justice Marshall there is still preserved a handsome crown given to the widow of the Indian chief by the English government. The old Eagle Tavern where Thomas Jefferson visited and where Lafayette and his son were given a brilliant ball is still standing. The Confederate Libby Prison, where so many Union captives languished and died, is another landmark. Then there are the homes of Robert E. Lee, Jefferson Davis, and Edgar Allan Poe; and Hollywood Cemetery, the burial place of presidents Monroe and Tyler, of John Randolph of Roanoke, and many other notable men, who sleep beside the 18,000 Confederate soldier dead. As the capital of the Confederacy, Richmond remained one of the chief objectives of the Union armies until Grant's capture of its lines of supply compelled Lee to evacuate it, April 2, 1865. A portion of the city was burned by the retreating Confederates.

In the state capitol, which was built after a model suggested by Jefferson, is Houdon's statue of Washington, of which John Marshall said that if you looked at it standing slightly to the right you got the best idea of how the real Washington looked. There is a replica in the Capitol at Washington, D.C.

The settlement of Richmond was founded in 1737, and incorporated as a town by Col. William Byrd in 1742. There are a number of parks, of which the one named after Colonel Byrd is the largest (300 acres). Population, about 175,000.

RIDDLES. "In at every window and every door crack, round and round the house and never a track." Can you guess this riddle? Your grandmother at your age probably guessed it and her grandmother before her. These puzzling questions called riddles have always been popular; and the wind has always been a favorite subject. The Wolof natives of Senegal put it in this way: "What flies forever and rests never?" The German riddle runs, "What can go in the face of the sun and leave no track?"

Riddles, like fables and folk stories, belong to all races and ages. Their guessing is an ancient game in which high prizes and heavy forfeits have been paid. The Bible has many of these old-time riddles. You will find them among the proverbs of Solomon, and in the fourteenth chapter of Judges there is a curious story of the riddle that Samson proposed to the Philistines. Among the ancient Greeks, also, the riddle was popular. It is found in the writings of their famous poets. Homer himself, legend says, died of chagrin because of a riddle that he could not guess. Among the well-known myths of Greece is the story of the Sphinx, a strange monster that crouched on a hill above the city of Thebes, waiting to kill men who passed by if they could not answer this riddle, which she put to them: "What is that which has four feet in the morning, two at noon, and three at night?" At last after many of his countrymen had perished because they could not guess it, there came Oedipus, who answered, "Man. As a baby he creeps on hands and knees, in mid-life walks on two feet, in old age totters along with the aid of a cane, or third leg." An ancient Norse myth tells of a riddle contest where the daughter of Thor was the prize. In the Middle Ages riddles were used merely as a pleasant pastime. Some have come down to us in an old collection called 'Amusing Questions'. It is well that solutions also are given, for who could guess such a riddle as "What is that that never was or never will be?"—the answer to which is, "A mouse's nest in a cat's ear."

Pun riddles are among the cleverest proposed today. "What is it that is black and white and red all over?" If "red" is spelled *read* it will give a clue, for the answer is "A newspaper."

The conundrum is first cousin to the riddle. It is founded on some old resemblance between unlike things or their names. "What kind of fruit does the electric plant bear?"—the answer being "currents." Or, "When is a door not a door?"—to which you reply, "When it is ajar" (*a jar*).

RIGA (*rē′gȧ*), LATVIA. Founded by German merchants of the Hanseatic League in the Middle Ages (1158), this city at the head of the Gulf of Riga—an arm of the Baltic—still has the air of a medieval

German city, with its high warehouses, spacious granaries and cellars, flanking narrow winding streets. Nearly half the inhabitants are Germans, with Letts, Russians, Esthonians, and Jews making up the rest of the population. The city stands at the mouth of the river Dvina and has long been the trade link between Germany and the rich basins of the Dnieper and the Volga, with which it is connected by a system of inland canals. Railroads also link it with the abundant forests of White Russia, with hemp-raising west central Russia, and the extensive flax-producing region of the northwest, and give it trade routes over which to market goods imported from western countries.

Until the breaking up of Russia, following the Revolution of 1917, Riga was a part of the Russian Empire and the czar's second port on the Baltic. Today it is the capital of the new state of Latvia (Livonia), which after 200 years of Russian rule has declared its independence. The harbor of Riga is not well protected and is closed by ice in the winter. Riga has important manufactures, including machinery and railway cars, but its chief importance is in its exports and imports. Population, about 570,000.

RILEY, JAMES WHITCOMB (1853–1916). This American poet who wrote of childhood with such tender pathos and humor was like Robert Louis Stevenson in having the vivid memory of his own earliest years that enabled him to interpret the impressions, feelings, and whimsical fancies of children. When he was over 40 years old he collected in 'A Child World' those of his poems which described the simple pleasures of his boyhood life in Greenfield, Ind., where he was born. And in that region of cornfields, meadows, woodlands, and orchards, there were many people who remembered the sturdy, flaxen-haired little boy with wide-open blue eyes who had been known affectionately as "Buddy" Riley. An active, daring, exploring little fellow, first to venture into "the old swimmin' hole" which he celebrated in verse, he was a leader in boyish sports. And because of his odd notions, gift of mimicry, and friendliness with babies, grandmother's hired men, and dogs, he was a welcome guest in farmhouses. But nobody, not even "Buddy" himself, dreamed that he was taking notes, when he listened to the pithy talk of older people in that racy "Hoosier" dialect of the pioneer days of the Middle West.

When Riley's village schooldays were done it was intended that he should study law in his father's office, but the adventurous youth ran away with a traveling patent medicine and concert troupe. He soon abandoned that shabby business to support himself by honest sign-painting; but by having to write "catchy" songs and to act in farcical little plays to hold the street crowds for the medicine peddler, he discovered his literary and histrionic talents. At 20 a poem contributed to a local paper brought him into newspaper work. Writing under the name of "Benjamin F. Johnson, of Boone," he won a delighted and growing audience for his dialect verse.

The best of his verse was admirable. As unerringly and lovingly as Burns in the Scottish lowlands, the "Hoosier poet" had caught the idiom of his own people and given to it a universality of experience and feeling. Riley was not limited to dialect, for he wrote in exacting forms of English verse with imagination, melody, and finished art; but he ranks with Bret Harte and a few other gifted Americans who created a distinctly native literature. He gave expression to an interesting and typical local condition of society that has now passed away. Dramatic abilities that would have won success on the stage he used in public readings from his own works, making them more widely known and admired.

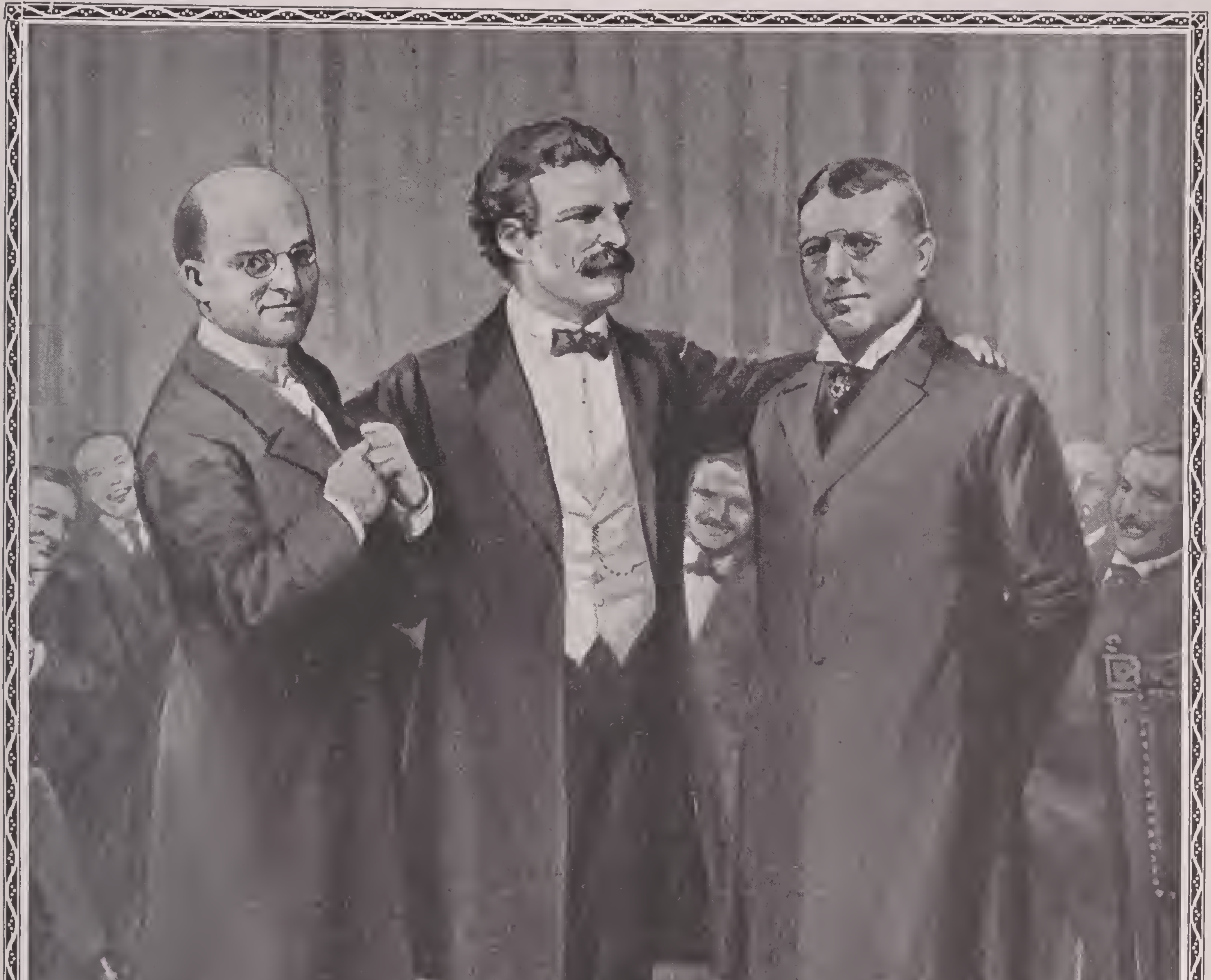
Up to old age he kept the flaxen hair, wondering blue eyes, and ingenuous look of boyhood; and when he read about "Little Orphant Annie" or "The Raggedy Man," the "Buddy" Riley he used to be came back to his face and voice, and won all hearts. A people's poet, of genuine gifts and appealing personality, Riley became the literary idol of Indiana. In his later years the school children of the state capital celebrated his birthday by marching in procession and leaving flowers at his home.

Riley's poems, complete in six volumes, were published in 1913. His best known books are 'The Old Swimmin' Hole' (1883); 'Afterwhiles' (1887); 'Pipes o' Pan at Zekesbury' (1888); 'Old-Fashioned Roses' (1888); 'Rhymes of Childhood' (1890); 'Green Fields and Running Brooks' (1892); 'Armazindy' (1894); 'A Child World' (1896); 'Rubaiyat of Doc Sifers' (1897); 'Home Folks' (1900); 'An Old Sweetheart of Mine' (1902); 'Out to Old Aunt Mary's' (1904).

RIO DE JANEIRO (*rē'ō dā zhȧ-nē'rō*), **BRAZIL.** In all the world there is perhaps no more picturesque and charmingly located port than Rio de Janeiro, the capital of Brazil and the second greatest city of South America. Steaming into its harbor, you see a gigantic cone of rock—the celebrated "Sugar Loaf" (*Pão d'Assucar*)—which guards the entrance on the left, and you gaze with interest at the odd aerial trolley which carries passengers thither in cars swinging high in the air. On the right, hardly less impressive, is the frowning mass of rock called Pico. Passing these you come suddenly into the pear-shaped bay, studded with lovely islands and surrounded by a wall of mountains of fantastic shape, most of them covered with tropical vegetation. All the navies of the world could ride at anchor in this huge bay. Curving around its western shore, on a long but narrow strip of land between the blue waters and the overhanging hills, lies Rio (as it is familiarly called), a radiant city of white spires and domes.

Leaving the steamer at the dock, you find yourself facing a stately thoroughfare with rows of royal palms and walks of fanciful mosaic designs, lined with great buildings of solid construction and modern architecture. Later you will motor to the end of this avenue, marked by the wonderful palace named after President Monroe of the United States, and there turn into the Beira-Mar, a famous boulevard which follows the line of the bay for many miles. The many parks

MASTERS OF MIRTH—THREE GREAT HUMORISTS


CHAS. SHELDON.

Bostonians of an older generation still chuckle reminiscently over the carnival of fun they enjoyed one famous evening in the winter of 1888-89, when Mark Twain, Bill Nye, and James Whitcomb Riley appeared on the same platform. Probably no such trio of funmakers has been seen in one entertainment before or since. Nye and Riley were starting out on a joint tour, and Mark Twain, who went up to Boston to hear them, was prevailed on to introduce them. When the trio appeared the surprised audience rose in a body and shouted at the top of their voices. After the uproar had subsided, Mark Twain presented Nye (at the left) and Riley (at the right) as "the Siamese Twins." "I saw them first," he said, "a great many years ago, when Mr. Barnum had them, and they were just fresh from Siam. The ligature was their best hold then, but literature became their best hold later."

are brilliant with tropical flowers which in more temperate climates are raised in hothouses. Palms wave their branches 150 feet above the ground, and tall bamboos interlock their feathery arms over the walks and shield pedestrians from the heat of the sun. Especially interesting are the Botanical Garden, where flowers from all parts of the world are cultivated, and the "Hunchback," or Corcovado, a hill whose summit you will ascend to enjoy the magnificent view.

This new Rio has arisen as if by enchantment from the old-fashioned city which visitors knew years ago. Since 1903 it has been largely rebuilt, at enormous expense. Sanitary reforms have transformed it from a port dreaded by seafarers, because of the prevalence of yellow fever, to one of the most healthful of tropical cities. The harbor, naturally one of the finest in the world, was dredged to make a broad shipping channel along the face of the new great stone quay, deep enough for the largest steamers. Hundreds of buildings were torn down in the business section at the same time to widen the streets.

The city derives its chief importance from commerce. Coffee is the principal export, and imports consist chiefly of food and manufactured articles. The most important industries are flour and textile mills.

According to Portuguese writers, the name Rio de Janeiro ("River of January") was given to the bay by a Portuguese captain who entered it in January 1502, and thought it to be the mouth of a large river. Population (including many foreigners), about 1,500,000.

RIO GRANDE (*rē'ō grän'dē*). Rising in the snows of the Rocky Mountains, and forming for hundreds of miles the border line between the United States and Mexico in its lower course, the Rio Grande is a stream of singular interest, both because of its geographic position and because of the colorful and contrasting phases it presents in its 2,000-mile course from southwestern Colorado to the Gulf.

It has often been the cause of international dispute since it was designated as part of the boundary line at the close of the Mexican War. Its shifting current and the diverting of water from its lower course for irrigation projects nearer the headwaters have caused frequent contention. Trouble has also arisen because of the fact that for months in the year it shrinks to such small proportions that in many places it can be forded on foot or horseback, and smugglers and bandits find no difficulty in crossing from one country to the other. United States troops, stationed at Fort Bliss, El Paso, and other border towns, keep a constant outlook for offenders, and the "line riders," mounted custom inspectors, watch the trails and passes in wild stretches of country.

The Rio Grande—the "big river," as its Spanish name means—exerts a powerful influence on the land it passes through. In some places it has made rich alluvial valleys; in others it plunges through picturesque rock-bound canyons, leaving the land on either side a desert. Where the yellow turbulent Pecos, its main tributary, pours into it near the town of Del Rio, there is a canyon hundreds of feet deep worn in the solid rock. For a large part of its journey along the border it pushes through yielding yellow sand, twisting and doubling on itself. Like the Mississippi in its lower reaches, the Rio Grande is constantly changing its course by wearing off an angle of land on one side of the river, and depositing the soil on the other side, or by cutting through a small neck of land, leaving a little half-moon of a lake as the only indication of its former course. But the boundary line, according to treaty, still remains at the center of the shifting current, and any land that the river in its vagaries deposits on its northern shore is under the jurisdiction of the United States, and additions to the southern shore line belong to Mexico.

The greater part of the Rio Grande basin lies in an arid region, and its waters were being used by the Indians for irrigation purposes when the earliest explorers visited the country. In spring the river is swollen by the melted snows of the mountains, and if there is also a heavy rainfall, disastrous floods sometimes result. Great dams have been built to conserve this flood water for the dry seasons. Elephant Butte Dam, recently constructed above El Paso in New Mexico, is the largest irrigation reservoir anywhere. The stored water is sufficient to last four dry seasons and to irrigate 300 square miles. The reservoir holds enough water, we are told, "to fill a standpipe 11 feet in diameter reaching from El Paso to the moon, or to cover Massachusetts to a depth of six inches." Some of this water goes to irrigate land in Mexico, by international agreement. The river is navigable for small boats for about 450 miles from its mouth.

RIVERS. The importance of rivers to man is seen in the great agricultural populations which their valleys and flood-plains support, and in the numberless cities that have grown up on their banks to take advantage of the transportation and waterpower which they offer. Their place in nature is no less conspicuous. They drain the land of its surplus water and with it they carry to the sea billions of tons of rock and mud and minerals. They are more important than all other agents in shaping land surfaces. They cut up high plateaus, creating magnificent rugged mountains; and in the course of ages they drop these mountains, bit by bit, into the sea. Aided by weathering, every river system is engaged in the task of carrying to the sea all the land of its basin which is above sea level; but few if any rivers actually reach that goal, for the river itself passes through a cycle of evolution, from youth to old age. As it gradually cuts down its steep slope, it changes from a rapid stream in a narrow valley to a wide sluggish one with little erosive power; and it may take as long to wear away the last few feet above sea level as all the other thousands of feet.

We commonly speak of only one "source" of a river; but a well-developed river system has as many sources as a tree has branches, all of which ultimately reach the trunk that empties into the sea. The water of rivers, furnished by rain and snow, comes at first from the sea by evaporation, or in less degree from lakes and other rivers. When rain falls on an uneven slope it is gathered into many little rills which follow the depressions in the surface, and immediately gorge-making begins. Much rain, especially upon level ground, soaks into the soil, but later seeps into the river when it has cut its channel deep enough, or comes up to feed streams in the form of springs. Those rivers which do not have access to ground water have usually only an intermittent flow, unless they have their sources in snow or ice fields or are fed by lakes.

A Rushing Start and a Placid Finish

At its source in the mountains the bed of a stream is steep and the swift river tears away everything that is in its path, causing rapids where it rushes over a rocky bed, or high waterfalls when it tumbles over cliffs. As the river leaves the mountains, however, the gentler slope of the land makes it less rapid and gives it power to carry only small stones, gravel, and mud. Near the ocean the slope of the bed diminishes still more, and the valley becomes a wide plain in which the river swings to right and left in great curves or "meanders" (so called from the river of that name in Asia Minor), laying down most of the burden which it gathered in the mountains. As the flowing river unites with the standing water of the sea, even the finest mud sinks to the bottom, and a plain is built up called a "delta," from its resemblance to the Greek letter Δ. At times of heavy rains, or in the spring when the snow melts rapidly, the shallow channel in the lower course of a river is unable to contain all its water, which then spreads over the surrounding country like a vast sheet. When the water subsides it leaves a thin layer of sediment behind, which in time builds up a broad flat "flood-plain," like that along the Nile and the Mississippi, where the soil is extremely fertile. High levees are often built along such rivers to protect the surrounding country; but such control cannot be permanently successful, for the sediment of the river raises its bed above the surrounding country, and in time the water overflows the levees. The Yellow River in China, called "China's Sorrow," is thus constantly changing its channel.

This is the typical river, of which there are many variations. Where the movement of the land is downward there are no deltas, but drowned river valleys, as in northeastern America. Floods cannot occur on rivers like the St. Lawrence, which have their flow equalized by lakes. In arid countries many rivers do not empty into the ocean, but end in deserts where they sink into the ground or evaporate. (*See also* Physiography; Valley and separate articles under the names of different rivers.)

GOOD ROADS *and* CIVILIZATION

Close Relation between Highways and Human Progress—The Paved Streets of Babylon, and the Magnificent Roads that Led to Rome—Indian Trails and Turnpikes—How the Automobiles Help—Streets and Street Paving

ROADS AND STREETS. Roads have been called a symbol by which the progress of a community can be measured. If people have no roads, they are savages; and if their roads are poor and little used, it is a sign that their civilization is stagnant. For "if there is any motion in society, the road, which is the symbol of motion, will indicate the fact." Without them commerce is impossible, and large cities cannot exist; communities are isolated, and interchange of ideas cannot take place. Roads are, indeed, not only the sign of civilization—they are one of the chief means for its advancement.

The importance of roads to the welfare of nations was not unknown to the ancients. The city of Babylon was paved as early as 2000 B.C., and Herodotus speaks of a magnificent Egyptian road which was built to assist in the construction of the Great Pyramid. The Peruvians, Chinese, and Carthaginians were also great road builders; but beyond question the greatest road builders of the ancient world were the Romans, whose stone-paved highways are the most solid structures in the way of roads found in any age. "All roads lead to Rome" was then literally true, for that city was the center of a network of wonderful highways reaching from the remote east to the farthest west, and even penetrating England. Many of them still remain as great monuments to the energy and skill of their builders, forming the foundation of modern roads and in some instances constituting the road surface now used.

In the Middle Ages the magnificent Roman roads were allowed to decay, and for over a thousand years none were built to take their place. The medieval traveler had to force his way through deep and miry lanes at a pace of two or three miles an hour, in constant fear of being stuck fast in some quagmire or overturned. Even in the time of Queen Elizabeth the only safe means of travel was by horseback or on foot. When stage-coaches were finally introduced (about 1659) Macaulay tells us that "it happened almost every day that coaches were stuck fast, until a team of cattle could be procured from some neighboring farm, to tug them out of the slough." As late as 1770 Arthur Young complained of a Lancashire road that its ruts actually measured four feet deep, and "a thousand to one break their necks or their limbs by overthrowings or breakings down. The only mending it receives is tumbling in some loose stones, which serves no purpose than jolting the carriage in a most intolerable manner." Small wonder that many people lived and died without traveling 20 miles from their place of birth!

In America Indian trails were for a long time the only means of travel except by water. As the population pushed inland these trails were generally widened into roads for the use of wagons, but they long remained in an intolerable condition. One of the most popular means of improving them was to place trunks of trees across the mud roads and leave them to settle there, producing what was called a "corduroy" road. Dickens describes vividly a journey over one of these in his 'American Notes' (1842): "At one time we were all flung together in a heap at the bottom of the coach; at another we were crushing our heads against the roof. Now one side was deep in the mire, and we were holding on to the other. The very slightest of the jolts with which the ponderous carriage fell from log to log was enough, it seemed, to dislocate all the bones in the human body." As trade increased, an insistent demand was made for better roads, and the toll-road era began. Although these private "turnpikes," which were maintained by tolls collected at certain sections on the road, were never popular with the public, they increased very rapidly. Before the beginning of the 19th century England had 30,000 miles of them, and after their introduction into America in 1790 the people invested in the stock of the turnpike companies a sum almost equal to the country's debt at the close of the Revolution. Since timber was plentiful in America, plank and corduroy roads were those most often built. Little improvement was effected in road-building until the 19th century, when two skilled engineers, Thomas Telford and John L. MacAdam, introduced scientific road-building in England. The latter's name is commemorated in our macadamized roads, which, as Dickens said, have benefited "our shops, our horses' legs, our boots, and our hearts."

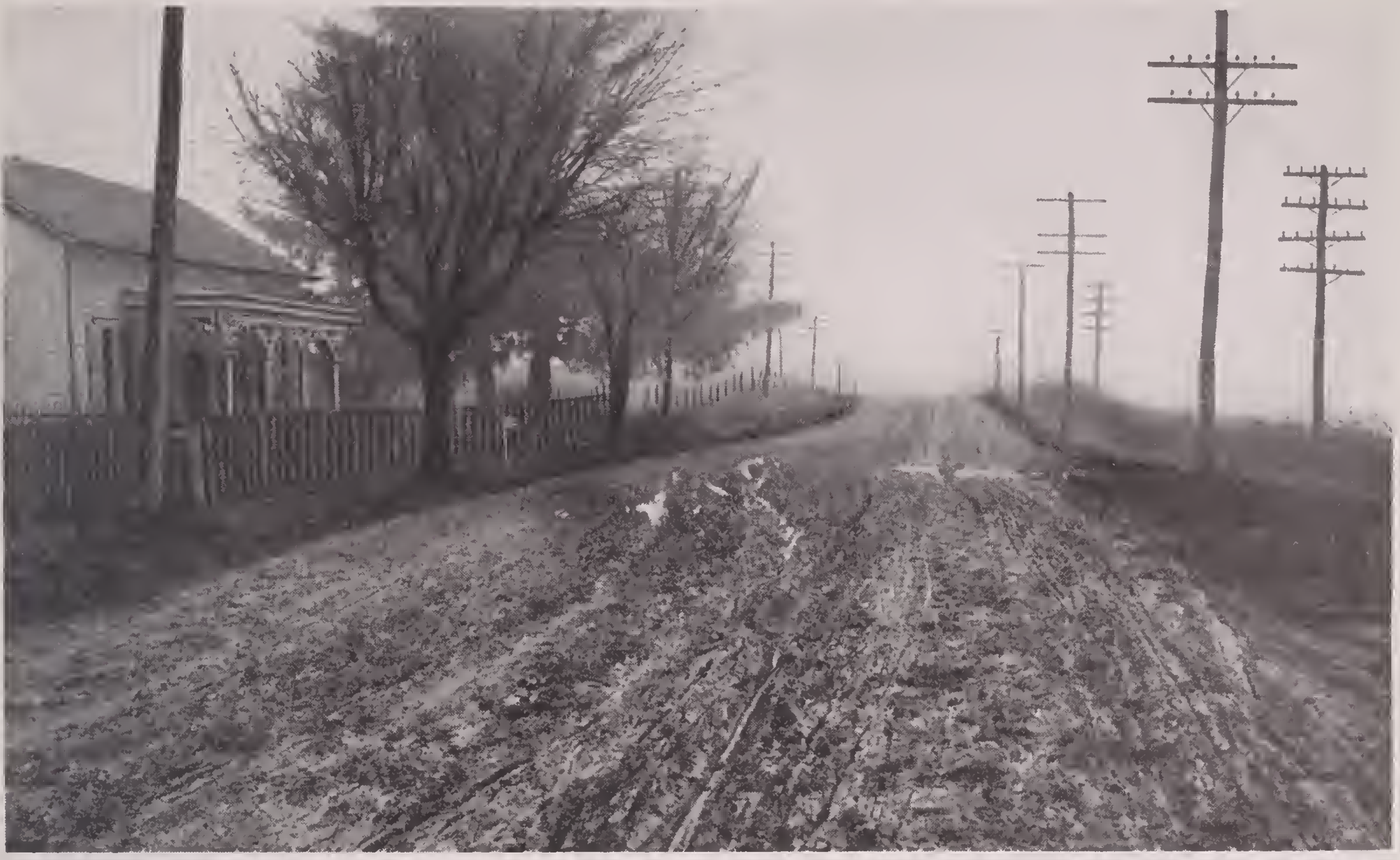
CLIMBING MOUNTAINS BY AUTOMOBILE

Where a few years ago even the prospector with his pack horse could scarcely make a toilsome ascent, splendid wide roads, like this section of the Pikes Peak Highway in Colorado, now enable tourists to race up mountains at high speed and in perfect safety.

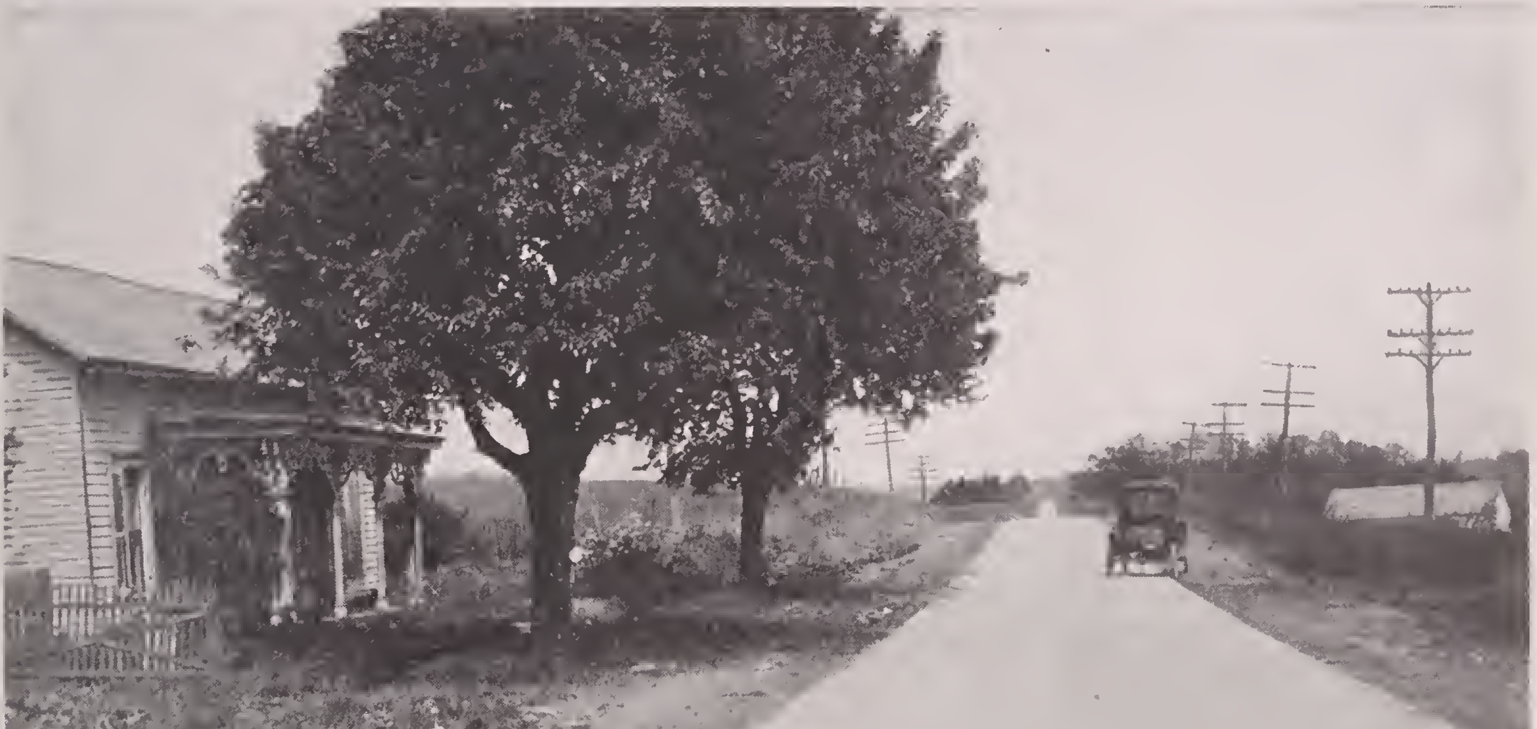
Road-building remained a purely local and usually private affair in America until 1806, when Congress began the famous National Pike or Cumberland Road to furnish better communication between the East and West. At a cost of $7,000,000 a great highway 800 miles in length was gradually constructed from Cumberland, Md., to Indianapolis, beyond which it was only partially completed. Thousands of prairie schooners followed it into the West, and it was one of the most important steps in national expansion. But with the coming of the railroads, Federal as well as state aid in road-building ceased for nearly half a century, because it was thought that roads would never be used for any but local traffic.

It remained for the automobile to give the next great impetus to the cause of good roads. Tourists who were adventurous enough to attempt to cross the continent a few years ago encountered meandering old trails which, owing to long years of disuse, were practically impassable. Time had all but obliterated the historic highways over which moved the commerce of the great West before the coming of the transcontinental railroads. Farming communities were indifferent or even hostile to road-building and its expenses. But with the advent of the automobile, the motor truck as well as the pleasure car, city and country alike awoke to the importance of good roads. Many of the old trails came again into use as part of the Old Trails Road, which comprises the National Road, the Boone Lick Trail, the Santa Fe Trail, which was the old route to the Southwest and Mexico, and the King's Highway, or Camino Real, which the Franciscan fathers followed in the early days in their journeys from mission to mission in California. The Jefferson Trail and the Mississippi Highway now span the continent from north to south in the Middle West, and the Pacific Highway connects Vancouver in British Columbia with southern California. Many of

THE SAME OLD ROAD, BUT WHAT A CHANGE!



Such roads! Such roads! In drier weather you were choked with dust on such roads as this, and after a rain—well, just look at it! Think of the mud, think of the ruts and the puddles—you could never tell how deep—and the poor farmer's horses straining under a heavy load that just had to be got to town! This is a post road, part of the old National Highway, about eleven miles west of Zanesville, Ohio. And so it used to look, but along came the Automobile and the Good Roads Movement, and then—



Only look at the change! A concrete road—really, a big, broad, smooth stone sidewalk—has been built through the country over this same route and others for thousands of miles; and so now we have such magnificent highways as the Santa Fe Trail, the Jefferson Trail, the Mississippi Highway, the Pacific Highway, the Dixie Highway, and the Lincoln Highway, stretching across the continent from ocean to ocean and from the Great Lakes to the Gulf. You can tell by the cottage and scenery that both pictures are of the same road, though a few trees have been felled and most of the fence has gone.

these are for the most part well marked dirt roads, which can be traversed with comfort only in dry weather. But there are also the Pikes Peak Highway, one of the highest and most wonderful of the earth's roads, which climbs the north side of that mountain; and the Lincoln and Dixie highways, which contain stretches of admirable hard-surfaced road.

HOW THOSE MAGNIFICENT HIGHWAYS ARE MADE

You've seen men laying a concrete sidewalk many a time, haven't you? Those wonderful country highways, that are really big, broad city sidewalks laid out across the country, are made in the same way. Here the cleats between the different sections have not yet been removed. But they will be as soon as the cement hardens, and in the spaces will be put a special composition that will allow for the expansion of the cement under the hot summer sun.

The Lincoln Highway is the wonder-trail of America, girding the continent from sea to sea, a distance of 5,000 miles. In from 20 to 30 days motorists can now travel from New York to the Golden Gate by following the gleaming red, white, and blue signs that mark the highway, passing through all the varied wonders of American scenery—the picturesque Appalachian ranges, the lowlands of the Mississippi with their forests, farms, and prairies, the great American desert, and the lofty Rocky Mountains—until California is reached, the state which possesses the most magnificent roads in the Union.

The Dixie Highway, completed in 1916, links the wintry north with the eternal summer of the everglades. It is shaped like a great spoon, the handle extending from Miami, Fla., to Chattanooga, where the road divides into two parallel lines extending north through Ohio and Indiana and following the shores of lakes Michigan and Huron until they meet at Mackinac, Mich. Together the roads have a length of 4,000 miles and traverse eight states.

The Federal Road Act, which became law in July 1916, has resulted in great activity among the states in road-building. This act provided some $75,000,000 of national funds for coöperation with the states in the making of rural roads, and an amendment of February 1919 appropriated an additional $200,000,000 for the same purpose. The states must pay at least one-half of the estimated cost of production and pay for the maintenance of the roads. The state highway departments select those which are to be improved and submit them to the secretary of agriculture for his approval. The act also provides, by a special appropriation, for roads in national parks and forests.

Most states now have highway commissions from whom maps and information about roads may be obtained upon application.

Macadam (named after the inventor) is the name given to roads built of broken fragments of hard stone (small enough to pass through a screen with meshes 2½ inches square diameter) arranged in a bed of from 6 to 12 inches in thickness, compacted by means of steam rollers, and surfaced with smaller pieces and gravel. For more than 100 years after MacAdam put down the first piece of this road in London, in 1817, this method was a leading form of improved road all over the world. *Bituminous macadam* is a new type of broken-stone road since the advent of the automobile has made it desirable to have a stronger binder; coal tar or asphalt is added to the top layers of crushed stone to make the surface dust- and water-proof.

Asphalt is one of the most satisfactory of paving materials, and since its first use in the United States, in 1867, to pave Pennsylvania Avenue in Washington, its use has increased rapidly. The asphalt, heated and mixed with sand, is laid hot, several inches thick, on a foundation usually of concrete, and hardens into a smooth, elastic, and durable substance for residence streets.

Cobblestone or bowlder pavements were once used extensively in the United States and elsewhere, but now their place, especially for heavy traffic, is usually taken by *granite blocks*, laid on a concrete foundation.

Brick, although one of the oldest materials used for paving, was not put to this purpose in the United States until about 1870. Since then its use has rapidly increased, both for residence and light-traffic business streets, and to some extent for rural roads. The pavements are made by laying specially hard paving bricks on a foundation of concrete, sand, gravel, or wood. The streets are easily cleaned and repaired, but are disagreeably noisy when traveled by horse-drawn trucks.

Wood block pavements are now much less used than formerly because of the increased price of lumber. Until about the close of the 19th century untreated round wood block pavements were laid in considerable quantities in localities where lumber was cheap, but they proved neither durable nor sanitary. The only form in actual construction at the present time is that of rectangular blocks treated with creosote or some other chemical to render them waterproof and laid on a concrete base. In Europe, especially in London, modern types of wood pavements have proved successful and popular.

Concrete seems to have first been used as a paving surface in Scotland about 1865, and since 1900 such streets and roads have become common, especially in the western United States. The ordinary thickness of such roads is 6 to 8 inches in the center and 5 to 6 inches at the edge.

ROBERTS OF KANDAHAR, EARL (1832–1914). In 1852 Frederick Sleigh Roberts, then a diminutive youth of 20 in the brand-new uniform of a lieutenant of artillery, and with the erect carriage acquired in the military school of Sandhurst, embarked from England for India. He was immediately nicknamed "Little Bobs" by the officers of his mess, in affectionate raillery. Quiet, keen, cool, a shrewd observer, and personally popular, his soldiers grew ashamed not to follow where "Little Bobs" led. Having been born in India, where his father was a general, it was easy for him to learn Hindustani so as to deal personally with native soldiers. He trained himself to remain in the saddle for 36 hours at a stretch. He had the geographical instinct that is invaluable to a soldier—he never got lost in the darkest night or the roughest country. For the rest, he never fell sick in the worst pest-holes of India; he was personally brave and proverbially lucky.

Employment for an officer so equipped was never lacking in India. He distinguished himself in the Indian Mutiny of 1857–58, in the Abyssinian expedition of 1867, and in the Afghan war of 1878–80, rising steadily in rank. His most brilliant exploit was performed as major-general in command of the column that marched from Kabul to the relief of Kandahar, covering the distance of 313 miles, through a hostile country in 22 days, gaining a complete victory. He served in India off and on for 41 years, and when he finally left the country in 1893 he was commander-in-chief of the army in India.

Lord Roberts, as he was now, was in his 68th year when disasters to the army in South Africa, in the Boer War of 1899–1901, demanded his presence in that field. "Little Bobs is at the helm at last" was the cry of relief from all England when he was appointed commander-in-chief in the field. He quickly brought order out of chaos, posted every man to the best advantage, and led the main column of the army of invasion. He struck at General Cronjé entrenched at Kimberley, captured Bloemfontein, capital of the Orange Free State, compelled the Boers to abandon the siege of Ladysmith, divided and demoralized the forces of the enemy, ignored the guerilla chief—General De Wet—and bluffed his way on scant rations into Pretoria, and so turned defeat into victory. But for "Little Bobs" South Africa would probably have been lost and Great Britain's hold on all her empire weakened.

Lord Roberts returned to England to succeed Lord Wolseley as commander-in-chief of the whole British army, and to receive the title of "earl of Kandahar, Pretoria, and Waterford." The remainder of his life was devoted to urging the principle of universal military service, which was actually adopted after the World War broke out. He died of pneumonia, November 1914, while on a tour of inspection of the British forces in France. His life may be traced in his autobiography, 'Forty-One Years in India'.

ROBESPIERRE (*rō'bĕs-pyĕr*), MAXIMILIEN (1758–1794). The ill fame of the giant in the story of 'Jack the Giant-Killer' is no greater than is that of Robespierre, to whom unthinkingly is laid all the blame for the atrocities of the Reign of Terror during the French Revolution.

As a student in Paris, and afterwards as a lawyer in his native city of Arras, Robespierre was noted for his ability and conscientious perseverance. His natural kindness of heart was shown by his resigning a judgeship rather than pronounce sentence of death, and later by his attempt to abolish the death sentence. His writings gained him a seat in the Estates-General of 1789, where he won fame by his popular views and earnestness of manner, in spite of the defects of a shrill voice, small stature, and nervous manner.

It was, however, in the Jacobin Club (*see* Jacobins) that Robespierre found his greatest opportunity. He became the acknowledged chief of that powerful body, and also a leader of the people of Paris. His reputation for honesty and incorruptibility contributed to his power.

In the "convention," the third of the French Revolutionary assemblies, Robespierre was the recognized leader of the radical party, called from their seats "the Mountain." He took a leading part in bringing the king to trial, declaring that Louis XVI "must die that the country may live."

Robespierre was also the best known member of the Great Committee of Public Safety (1793–94), which saved France from conquest by foreign enemies from without and revolts within in the trying time of the Terror. But he was not a man of action, rarely attended the sessions, and had almost no part in its routine work. The credit for France's titanic efforts, as well as the blame for the pitiless guillotinings of that time, belong to men of obscurer name (*see* French Revolution).

In personal life and in principle Robespierre was a Puritan, and in all things a believer in the teachings of Rousseau (*see* Rousseau, Jean-Jacques). As a deist (a believer in God, though not in Christian revelation) he sent to the guillotine Hébert, who had closed the churches and set up a grotesque worship of "the goddess Reason." Danton, to whose superb energy and audacity the triumphs of the Revolution were largely due, was guillotined because he believed that the Terror had accomplished its work and that the time for moderation was at hand (*see* Danton). Then to check atheism, Robespierre introduced the "Reign of Virtue" and the worship of "the Supreme Being" with an elaborate festival.

Most of Robespierre's associates on the Committee of Public Safety, however, had little sympathy with his ideas. It was said of him that he had "made Virtue odious by continually prating about it." Many feared lest they might be sacrificed, as Danton had been, to Robespierre's love of power and narrow self-righteousness. On July 27 (the 9th Thermidor in the Revolutionary Calendar), 1794, his enemies forestalled an attempt against themselves by obtaining the arrest of Robespierre, Saint-Just, and others of his intimates. Robespierre was shot in the jaw in an attempted rescue, and next day he and his adherents were guillotined by order of the Convention. Danton's words, "Robespierre will follow me; I drag down Robespierre," thus proved true. With the fall of Robespierre the Terror soon came to an end.

"ALL'S RIGHT WITH THE WORLD!"

Robin Red Breast never read Browning, but he is expressing the spirit of blossom time as well as the poet ever did.

ROBIN. "Cheer up!" cries the robin—and then he practices what he preaches. On a frosty spring morning when worms stay safely below reach of his hungry beak, he never mopes, but from a bare limb of a tree he coaxes them up with a real spring song. On a rainy evening his call is as cheerful as a rainbow.

The robin's friendly trustfulness has won for him the love of all classes of people. From the Gulf of Mexico to Alaska his comings and goings are noted by young and old. And his place in our literature extends from the nursery rhyme of "Robin, robin redbreast," to the verse of the major poets.

This little optimist is ten inches long. His black head is set off by the yellowest of beaks and the brightest of eyes. His back is a dark mouse-gray; there are slight markings of white about the head and tail, but it is his gay rust-red breast that all children know and love, and they should read the legend of how he got it as it is told in Lowell's poem. His mate has similar plumage, with a paler breast; his children, like all young thrushes, to which family the robins belong, have speckled breasts. (For illustration in colors, *see* Birds.)

The nest of mud-plaster and grass is supported by twigs, leaves, twine, or rags. It is familiarly placed about the door-yard, in a tree or on a ledge of a building. There are three to five greenish-blue eggs of the lovely tint which, as robin's-egg blue, is now shown in all dainty fabrics. Each summer two broods of young are hatched, sometimes three.

In the autumn, robins migrate to the Southern states. There they congregate in flocks of thousands in cedar glades or swamps where there are gum trees. Here they grow fat on berries of these trees, and here, until the passage of the Federal migratory bird law, many thousands were slaughtered and sold in the markets.

Robins surely deserve the protection they now receive. Almost half their food is harmful insects. Of the remaining vegetable matter there is ten times as much of wild as there is of tame fruit. Their cherry-thieving habit is due to the fact that cherries ripen before the wild fruits, which they really prefer; and after their long spring diet of fishworms, who can blame them for taking cherries rather freely?

The European robin of another bird family, the warblers, is only about half as large as our robin. His breast is a brighter orange-red. He is found in Europe, western Asia, and northern Africa, but is especially at home in Great Britain where he goes by the pet name of "redbreast." The scientific name of the American robin is *Merula migratoria;* of the European robin, *Erithacus rubecola.*

ROBIN HOOD. In the days when the Plantagenet kings ruled England, the bold outlaw Robin Hood and his merry men roamed the green glades of Sherwood Forest near Nottingham town, in the center of England. There they lived a mirthful life, as the old ballads tell us, hunting the king's deer and levying toll on proud churchmen and cruel nobles.

No archer ever lived that could speed a gray goose shaft from the longbow with greater skill than Robin Hood. And his heart was as true as his aim was sure. All the people round about him loved him, for he despoiled the fat abbots and monks and lords who oppressed them, and he shared his spoils with the poor and needy. He was fair in war and courteous even to his foes. He shed no blood if he could help it, and never let harm befall women and children.

And how came good Robin to be an outlaw? You must know that in those days the forest laws were very strict, and because Robin Hood had once killed one of the king's deer, and had also, as some of the old stories tell us, slain one of the king's foresters who threatened his life, a price was set upon his head and he was forced to flee into the depths of the greenwood.

Soon other bold men who were outlawed like himself, or who hated the hard rule of the barons, or who loved the free life of outdoors better than the settled life of industry, joined themselves to him. And so grew that merry band which included Little John, Will Scarlet, Friar Tuck, Allan-a-Dale, and other familiar characters of the story.

Was Robin Hood a real person? Many scholars believe there is some historical basis for the legends; that they grew up about some actual victim of the ruthless forest laws of the Norman kings. But it is impossible for us to separate the mixture of fact and fancy in the mass of ballads that deal with him.

What we do know is that the character of Robin Hood represents to us the ideal of the common people in the later Middle Ages, as King Arthur represents the ideal of the upper classes. He stands for liberty and the rights of the people against oppressive laws and the tyranny of the nobles. He robs the rich to give to the poor, and puts at naught the laws and customs which bore so heavily on the common folk.

All countries have their outlaw heroes, more or less legendary, who defy unjust authority and perform miracles of prowess against the oppressors. Robin Hood thus holds a place with the legendary William Tell of Switzerland, with Rob Roy of Scotland, and with the historical Wat Tyler and John Ball, who led the Peasants' Revolt in England in 1381. The most ancient ballads of Robin Hood have been lost, but between 30 and 40 have been preserved, some of them dating as far back as the 14th century. In addition to these, the chief source of the legends, as we know them today, is the 'Little Gest of Robin Hood' (*gest* meaning a tale of deeds), printed about 1500, which was compiled from a number of the older ballads.

Two Adventures of Robin Hood and His Merry Men

How Little John Got His Name

"NO SPORT have we seen for fourteen days," said Robin Hood one bright spring morn, "so now I will go abroad to seek adventures forthwith. But tarry ye, my merry men all, here in the greenwood; only see that ye mind well my call. Three blasts upon the bugle horn I will blow in my hour of need; then come quickly, for I shall want your aid."

So saying, he set off and strode along until he came to a narrow bridge that spanned a little stream. At one end of it there stood a man, a good seven feet tall, who carried a staff that looked like a small tree trunk.

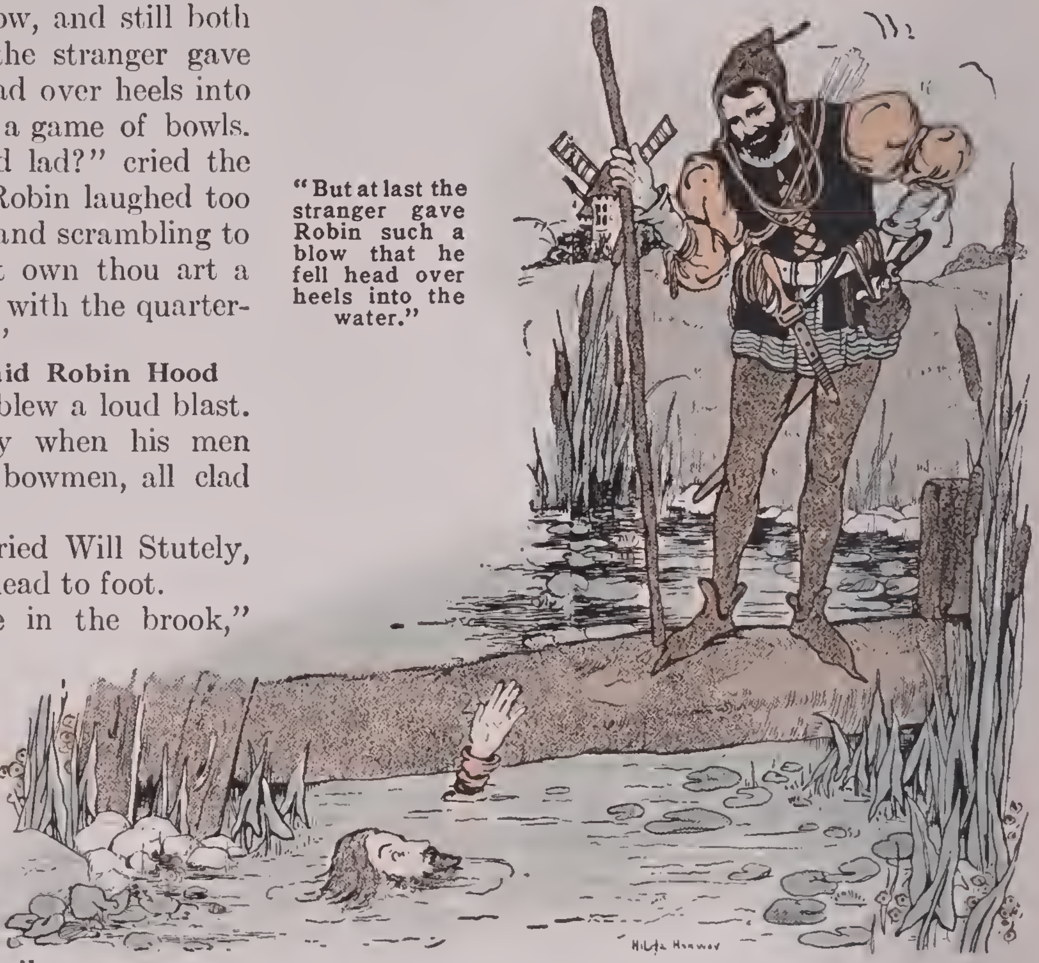
"Now stand thou back," quoth Robin, "and let the better man cross first." "Nay," answered the stranger, "then stand back thine own self, for the better man am I."

"That we shall presently see," said Robin Hood, "for if thou movest one step forward, I will send a good Nottingham shaft betwixt thy ribs."

"Thou pratest like a coward," said the stranger, "to talk of shooting with thy bow, when I have only this plain staff to defend myself."

"Faith, never have I had a coward's name in all my life before," replied Robin, and so saying he went to the wood and cut himself a stout oak staff, six feet in length. Then taking their staffs by the middle with the two hands wide apart, Robin and the stranger stepped upon the narrow bridge and gave blow for blow in one of the stoutest quarterstaff bouts that ever man saw. Robin smote the stranger upon the ribs until his jacket smoked like a damp straw thatch in the sun, and the stranger gave Robin a crack on the crown that caused the blood to flow, and still both kept their footing. But at last the stranger gave Robin such a blow that he fell head over heels into the water, as the queen pin falls in a game of bowls.

"And where art thou now, good lad?" cried the stranger, roaring with laughter. Robin laughed too as soon as he could get his breath, and scrambling to the bank he said: "I needs must own thou art a brave soul as well as a stout fellow with the quarterstaff, and hast fairly won the fight."



"But at last the stranger gave Robin such a blow that he fell head over heels into the water."

"A Fair Fight Fairly Won!" Said Robin Hood

Then he set his horn to lip and blew a loud blast. Scarcely had the echo died away when his men appeared, a score or two of stout bowmen, all clad in Lincoln green.

"Good master, how is this?" cried Will Stutely, seeing Robin Hood dripping from head to foot.

"Yon fellow hath tumbled me in the brook," replied Robin.

"Then in he shall go, too." And the lads made for the stranger, and would have given him a good ducking and also a drubbing, had not Robin cried out, "Nay, forbear! He hath beaten me in fair fight, and if he will stay with us and be one of our men he is right welcome."

"What name goest thou by?" he asked as the stranger gave him his hand.

"John Little," answered the stranger solemnly, at which all the men laughed heartily, and Will Stutely cried out:

"Little art thou indeed, and small of bone and sinew, and therefore shalt thou be christened Little John!"

"'John Little', answered the stranger solemnly, at which all the men laughed heartily."

"Then come, my merry men," quoth Robin Hood, "and we will prepare a christening feast for this fair infant."

So through the forest they went until they came to a great oak tree with broad-spreading branches and neath it a seat of green moss where Robin was wont to sit at feast and merry-making with his good men about him. A brace of fat does from the king's fine herd was brought forth and a barrel of humming ale was broached.

Then whilst great fires crackled and the savory smell of sweetly roasting venison filled the glade, some of the men stood forth and contended with the quarterstaff, whilst others set up garlands on the branches of trees and shot at them in archery practice. When the feast was ready, all sat down, and Robin Hood placed Little John at his right hand.

And thus, amid jest and song and good cheer, they christened Little John, who was to win renown second only to that of Robin Hood himself.

The Shooting-Match at Nottingham

NOW you must know that all this time the proud Sheriff of Nottingham was trying in vain to bring Robin Hood to justice. So many times had he tried and failed that the king had spoken harsh and scornful words. Then at last he bethought himself how he might use guile to capture the daring outlaw.

"STRAIGHT FLEW THE ARROW TO THE VERY CENTER"

contained in the Easy Reference Fact-Index at the end of this work

"It is of no avail," thought the Sheriff, "to seek out that evil knave Robin Hood in his woodland haunts. But if I could only persuade him to come nigh to Nottingham Town, I warrant I would lay hands upon him so stoutly that he would never get away again."

So he bethought him to proclaim a great shooting-match to which everyone who could draw a longbow should be bidden. An arrow of gold was to be the prize and he who won it fairly and squarely should be hailed by all as the greatest archer throughout the length and breadth of the land.

"If I know aught of Robin Hood," quoth the Sheriff, who was Robin's greatest enemy, "he will never submit to see that title won without making trial to win it himself."

When Robin Hood heard of the Sheriff's proclamation he called his men about him and said: "I fain would have one of us win this fair prize that our sweet friend the Sheriff offers; and therefore will we take our bows and shafts and go to Nottingham Town. What say ye, lads?"

"Have a care, good master," said one of his followers. "I have heard it said that this same shooting-match is but a trap whereby the knavish Sheriff would draw thee into the town and so beguile thee."

"Then," said Robin, "must we meet guile with guile. We shall lay aside our suits of Lincoln green and go in disguise—some as shaven friars, some as rustic peasants, and some as tinkers or as beggars. How like you the plan, my merry men all?"

"Good, good!" cried all the band right heartily.

The great day was arrived, and at the appointed time the Sheriff took his place in the seat of honor near the target. Leaning forward he scanned the crowd of archers that had come from far and near throughout merry England, but he saw none clad in Lincoln green, such as was worn by Robin Hood and his men.

And now the archers began to shoot, each in turn; and never had the good folk seen such archery as was shown that day. The ten best men were chosen to shoot again.

"Seest thou Robin Hood amongst those ten?" asked the Sheriff of a man-at-arms who stood near him.

"Nay, that I do not, your worship," answered the man. "Six of them I know right well and of the others none is of Robin Hood's size except perhaps that tattered beggar in scarlet, and he has a beard of brown instead of yellow, besides being blind in one eye."

Each of the ten now shot again, and then from these the three best were chosen for the final contest. One of these was the tattered stranger in scarlet with the patch over one eye; another was Gilbert o' the Red Cap, one of the Sheriff's own archers. Twice they shot, all three, and it was soon seen that the match lay between Gilbert and the tattered stranger. On the third shot Gilbert's shaft lodged close beside the spot that marked the very center.

"Well done, Gilbert!" cried the Sheriff joyously. "Now, thou ragged knave, let us see if thou canst shoot a better shaft than that."

An arrow came through the window with a scroll attached. The Sheriff grew red with rage as he read the scroll and learned that he had given the prize to Robin Hood.

All held their breath as the ragged stranger stepped forth. Hitherto he had shot so quickly that one could scarce take breath between the drawing and the shooting; and men marveled that one blind of one eye could shoot so well. Now he shot with greater care, holding his trusty yew drawn for a moment before loosing the string. Straight flew the arrow and so true that it smote a feather from off Gilbert's shaft and lodged in the very center.

"Here, good fellow," quoth the Sheriff as he stepped down in silks and velvets to where the tattered archer stood. "Take thou the prize, for well and fairly hast thou won it. I trow thou drawest better bow than that same coward knave Robin Hood, that dared not show his face here this day."

The Feast of Victory

That afternoon, in the depths of Sherwood Forest, Robin Hood's men feasted merrily, but the soul of their leader was vexed. He it was who had won the prize from the Sheriff's own hands, and the Sheriff's words rankled in his heart. "I would fain let him know who it was that won the golden arrow from out his hand," at last said Robin.

Then up spoke Little John: "Let me but go to Nottingham Town, and I will send yon Sheriff news of this by a messenger such as he does not expect."

That night as the Sheriff sat at meat in his great hall talking of the shooting-match and wondering who might be the bold archer who had won the prize, a blunted gray goose shaft with a small scroll attached came through the window and fell upon the table.

The Sheriff opened the scroll and grew red with rage, for on it he read:

Now Heaven bless thy grace this day,
Say all in sweet Sherwood,
For thou didst give the prize away
To merry Robin Hood.

—*Retold from Howard Pyle's 'Merry Adventures of Robin Hood'.*

ROB ROY. The real name of this celebrated Scottish outlaw of the late 17th and early 18th centuries, whose adventures entitle him to be considered the Robin Hood of Scotland, was Robert MacGregor (1671–1734). His name "Roy" came from his ruddy complexion and red hair, for it is the Gaelic word for "red." At times he was known by his mother's name of Campbell, owing to the fact that the clan MacGregor had been outlawed by the Scottish Parliament. He was famous as a broad-swordsman, in which manner of fighting his long arms gave him an advantage. In 1693, although not the nearest heir, he was chosen head of the MacGregor clan.

Like many of the Highland landed proprietors of that time, Rob Roy engaged in the business of grazing and selling Scottish black cattle for the English market; and to protect his herds he kept about him a band of armed followers. His greatest troubles began in 1712, when the Duke of Montrose, from whom he had borrowed money for his cattle business, seized his lands on account of this debt and had him proclaimed an outlaw.

Rendered desperate by misfortune, Rob Roy collected a band of his armed clansmen and made war on the duke, robbing him of his cattle and preventing him from receiving the rents of his tenants. Many stories are current in the neighborhood of Loch Lomond and Loch Katrine of Rob's narrow escapes from capture by the troops that were sent to take him. Many instances also are recorded of his kindness and liberality to the poor, whose wants he often supplied at the expense of the rich.

In 1722 he gave himself up to the English authorities. After being imprisoned for a time he was sentenced to be transported to the New World, but was pardoned and permitted to return to his home in the Highlands, where he died in 1734. Rob Roy's exploits have been immortalized in Sir Walter Scott's novel which bears his name.

ROCHAMBEAU (*rō-shăṅ-bō'*), **JEAN BAPTISTE DONATIEN DE VIMEUR, COUNT DE** (1725–1807). For 33 years before he was sent to America to aid the American colonists in their struggle for independence, Count Rochambeau had served in the French Army, and by his valor had won glory and promotions. Following the treaty of alliance in 1778 between the French king and the revolted English colonies, Rochambeau was made lieutenant-general and dispatched with 6,000 men to the aid of Washington. There his services at Yorktown, in 1781, helped largely to bring to an end the six years' struggle.

When the struggle against despotism began in his own country in 1789, Rochambeau for a time took part on the side of the Revolution. But he soon became disgusted at the excesses of the leaders, and resigned his command. During the Reign of Terror he was imprisoned as the enemy of his country and narrowly escaped the guillotine; but under Napoleon his estates and his position were restored to him. In 1902 the Republic of France presented to the United States a statue of Rochambeau, which now stands in one of the parks of the city of Washington.

ROCHESTER, N.Y. "Rochester made means Quality" is the slogan of this city, the third in size in New York state, which excels in an extraordinary number of things. It was the "Flour City" when the Genesee valley was the center of the American wheat belt; it is now the "Flower City" (the nursery having succeeded the milling industry), the "Kodak City," and the "City of Varied Industries."

Best of all, it is a city with an active public spirit, expressed not merely in the multiplication of industries and their cash returns, but in the improvement of living conditions for its citizens. Rochester has no slums; most of its working people own their houses. Its pure milk standards and low infant death rate are nationally known.

Situated on the beautiful Genesee River seven miles from where it flows into Lake Ontario, and the New York State Barge Canal (formerly the Erie Canal), Rochester owes its eminence in manufactures primarily to water-power and water transportation. The Falls of the Genesee furnish the one, and the lake and the canal the other.

The city manufactures more than 350 commodities, chiefly goods requiring highly skilled artisanship. It leads the world in some of these. The Eastman Kodak Company is the largest camera-manufacturing and photograph supply concern in the world; and since the World War, Rochester takes first place in the production of optical glass for field glasses, telescopes, etc., for which the United States formerly depended chiefly upon Germany. Rochester also makes more carbon paper, typewriter ribbons, and fine ivory buttons than any other city in the United States. In the manufacture of men's clothing it gives place only to Baltimore, Chicago, and New York, and it ranks fourth also in the boot and shoe industry. Check protectors, thermometers, filing devices and office systems, and enameled steel tanks are other important products.

Rochester is the greatest American nursery garden center, having some of the largest nursery and seed establishments in the world. Situated in a rich farming and fruit country, it also has important fruit- and other food-canning establishments, and makes soda fountain fruits and syrups.

Rochester's extensive park system was planned by the famous landscape architect, Frederick Law Olmsted. The University of Rochester, the Rochester Theological Seminary (both Baptist institutions), and the Mechanics' Institute are among its important educational institutions. Population, about 296,000.

ROCKEFELLER, John Davison (born 1839). The name of John D. Rockefeller will always call to mind four things—oil, the relentless business methods of a great builder of a "trust," the accumulation of the greatest fortune in the world, and the distribution in wise gifts of nearly half a billion dollars.

Rockefeller was born in Richford, N.Y., whence his parents moved to Cleveland, Ohio, when John was 12 years old. He received a common school education, and at 19 he was a business partner in a produce commission firm. In 1862 he embarked on his life career when he and his brother William and associates entered the oil business. In 1865 they built in Cleveland the Standard Oil Refinery. The chief factor in their early success was an Englishman named Clark whose discoveries improved the oil refining process.

In 1870 the various interests of John D. and his brother William were incorporated as the Standard Oil Company, with John as president. Its object was to obtain control of the whole petroleum industry of the United States. Besides the Rockefellers, keen and clever business men like Henry M. Flagler and H. H. Rogers were drawn into this young corporation. Rockefeller early realized two great things—the importance of control of the market, and the advantage to be obtained from a combination with the railroads as a means of transporting his products and blocking his rivals. In the period of the 1870's the railroads were competing desperately for business by giving rebates and drawbacks. The Standard Oil Company seized every open and secret means it could. Not only did it secure from the railroads a rebate from the published rates on all the oil shipped by the Standard Oil Company, but it also forced them to pay to the Standard Oil an agreed sum for every barrel of oil which the railroad carried for its competitors. Armed with this double-edged sword, the Standard Oil Company quickly put its rivals out of business, by forcing them to sell out on terms laid down by the Standard Oil. Owners of oil wells were equally dependent on the one great oil refining company, and so an enormous business, controlling 95 per cent of the oil refining and yielding great profits, was built up in ten years. There was public agitation and finally legal action. The Standard Oil Company was dissolved in 1892 into 20 companies, but combined again and was again prosecuted and dissolved in 1911. Today the whole system of rebates by which the Standard Oil Company was built up is strictly forbidden by law, under heavy penalties. Mr. Rockefeller has declared under oath that he was not the originator of the practices by which this great company built up its monopoly. More legitimate factors in the growth of Standard Oil are the system of pipelines which it has built to bring crude oil from the producing fields to the refineries, and the improvements and economies which its staff of scientific experts introduce into every branch of producing and marketing its manifold products.

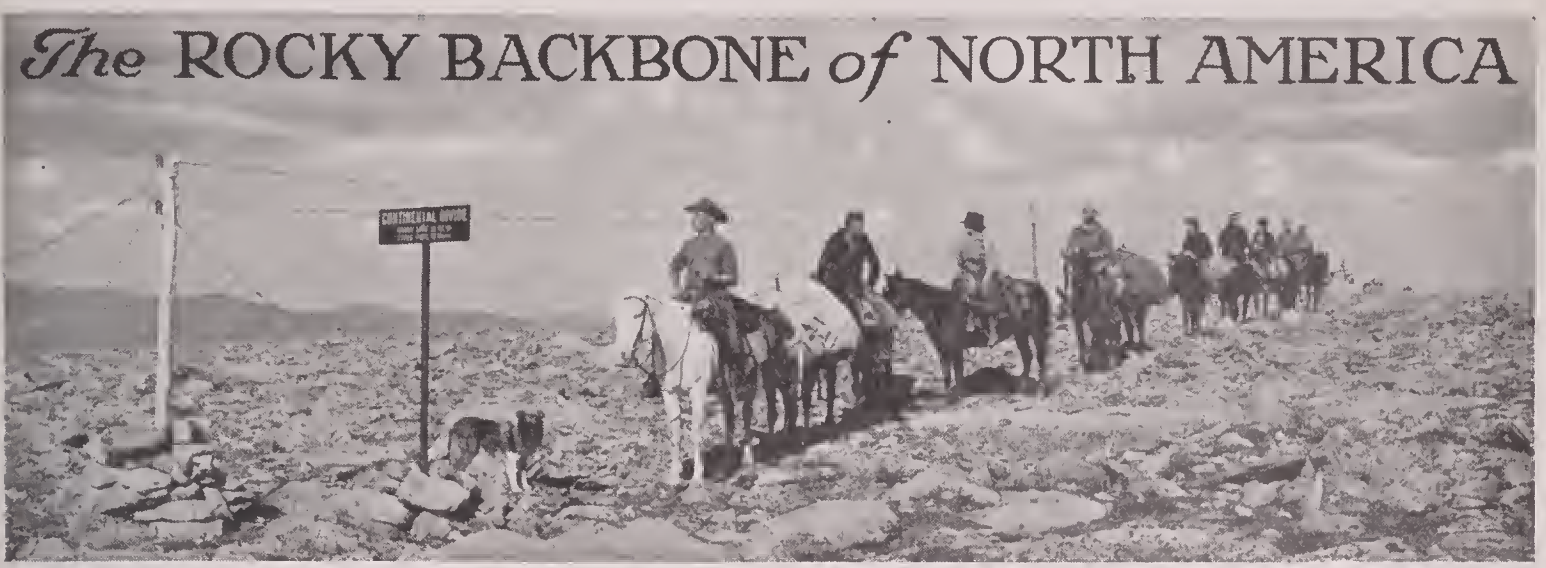
After 1895 Rockefeller became less active in the company and wholly retired from its management in 1911. In addition to oil, his prodigious wealth found fields of investment in coal and iron mines in Colorado and elsewhere, and in banking and other enterprises of a hundred kinds. No accurate estimate has ever been made public of the size of Rockefeller's fortune, but it is generally believed to be more than a billion dollars, making him the richest man in the world.

JOHN D. ROCKEFELLER
The Croesus of the Modern World

Of this immense fortune Rockefeller has distributed about $500,000,000 in wise and well-considered gifts. Much of this sum has gone to support education, scientific research, public health and medical education. He founded the University of Chicago, and, through the general Education Board which he established in order to distribute his gifts for educational purposes, did much toward the promotion of practical farming, the establishment of public high schools in the Southern states and of schools for negroes, and the promotion of institutions of higher learning. The Rockefeller Institute for Medical Research, which he founded in 1901 in New York City, consists of a splendidly equipped hospital and laboratories in which scientific investigations are carried on by a corps of specialists with reference to the prevention and cure of disease.

A wide range of activities—charitable, religious, missionary, and educational—is covered by the Rockefeller Foundation, established in 1913 for the purpose of "promoting the well-being of mankind throughout the world." Among its important activities have been the organization of a world-wide campaign against the hookworm disease, the establishment of the China Medical Commission for the promotion of public health and medical education in China; the conducting of an investigation of the relations between capital and labor, and war relief work in coöperation with the Belgian Relief Commission, the Red Cross Society, and other organizations.

The ROCKY BACKBONE *of* NORTH AMERICA



On the "Ridge of North America"—a Camping Party Crossing the Continental Divide

ROCKY MOUNTAINS. This long multiple chain of rocky and snow-capped mountains that runs through North America, from the border of Mexico to Alaska, is sometimes spoken of as the backbone or the roof of the continent. In Colorado alone the mountain area is three times that of the Alps, and it includes more than 300 peaks that rise far above the timber line. There are no less than six national parks in the Rockies, not counting other reservations. The name Cordilleran system is now generally given to the whole series of highlands stretching through western America from Panama to the westernmost of the Aleutian Islands, and extending from the Great Plains on the east to the Pacific Ocean on the west; and of these highlands the Rocky Mountains are the eastern half.

The scenery in the Rockies varies from the strange formations of the Yellowstone region, in northwestern Wyoming, to the Alpine landscapes of Glacier National Park in Montana and the flat-topped mesas of New Mexico. In the northern Rockies are numerous small glaciers, though there are few elsewhere in the system. In Colorado, the typical Rocky Mountain state, the mountains occur in several parallel north and south ranges, with broad grassy parks or valleys in between. These smooth valley floors, lying at altitudes of from 6,000 to 7,000 feet, slope gently to the base of the mountains. Colorado contains some of the sources of every great western river except the Columbia, which rises in Montana.

In climbing one of the Rockies—Pikes Peak, for instance, which rises 14,108 feet from the plain—you find the greater part of your way lying through forests. At 11,000 feet or 12,000 feet the trees finally give way to sturdy healthy growths, but not without a struggle. On the frontier line the trees stand only eight or twelve feet high, deformed by the buffeting of the wind, their straggling branches all pointing leeward. Sometimes they crawl along the ground instead of standing at all.

But the summits are not so bare as they look from a distance above the dark cloak of forest. In the United States especially there are no perpetual glacier caps as there are in Switzerland, and wherever soil can cling to the gentler slopes, you will find Alpine pastures, rolling moorlands, and wet meadows like the Arctic tundra. Sometimes there are acres of low tangled growth—wintergreen, huckleberry, Arctic willow, and black birch; sometimes carpets of columbine and paintbrush, crimson purple primroses, spring beauties, daisies, buttercups, forget-me-nots, or purple asters and goldenrod, according to the season. Now and then you come upon a little blue lake lying in a cup hollowed out by some glacier millions of years ago. There are a thousand or more of these exquisite lakes in Colorado alone.

Among the sheer walls and shattered summits breaking off into canyons, at heights of 12,000 feet and more, you may catch sight of the mountain sheep. Following their leader they make long flying leaps from one slender shelf of rock to another, rarely coming to the lower levels except to visit some salt lick. In the winter they huddle together against the side of a ledge and let the snow blow over them as it will. Below them the slides thunder down, trailing a spray of snow. Other animals of the Rockies are the mountain lion, the sheep's greatest enemy, and the black and grizzly bears.

It is only in our own day that the Rockies have become a playground for the nation. In 1803, when the Rocky Mountains constituted the western boundary of the Louisiana Purchase, no white man had ever looked upon their northern ranges. And before 1840 the smoke of the trapper's campfire, and a few scattered trading posts—far up the headwaters of the Missouri and other rivers, or over the Continental Divide at the headwaters of streams flowing into the Pacific—were almost the only trace of the white man in the Rockies. The trappers would spend their winters laying traps and trading with the Indians, and in the spring would float their furs down with the spring freshets to St. Louis.

Next came the miners, about 1858, some ten years after the discovery of gold in California. Almost all the ranges of the Rocky Mountains are rich in some sort of ore. There is gold and silver in Colorado, Utah, and the Black Hills of South Dakota, and copper in Montana and New Mexico.

But today the typical industry of the Rocky Mountain states is neither trapping nor mining, but farming. Even in Colorado the annual product of irrigated lands is often more than that of its mines.

Geologically the Rocky Mountains are much younger than the worn-down and re-elevated Appalachians. They were formed by numerous long-continued movements of geologically recent date, consisting of repeated irregular uplifts. In the United States some of the chief ranges are the following: The Bitter Root, Coeur d'Alêne, Mission, and Salmon River ranges of Idaho and Montana; the Wind River, Teton, and Laramie mountains of Wyoming; the Wasatch Mountains of Utah; the Front Range and "Park" Mountains, Sangre de Cristo Range and Sierra Blanca in Colorado; and the Sacramento Mountains in New Mexico. Important peaks are: in Idaho, Hyndman Peak (12,078 ft.); in Montana, Mount Douglas (11,300 ft.); in Wyoming, Fremont Peak (13,790 ft.), Grand Teton (13,671 ft.); in Utah, Gilbert Peak (13,687 ft.); in Colorado, Mount Massive (14,402 ft.), Blanca Peak (14,390 ft.), Harvard Peak (14,375 ft.), Longs Peak (14,255 ft.), Holy Cross Mountain (13,978 ft.), Pikes Peak (14,108 ft.); in New Mexico, Cerro Blanco (14,269 ft.), La Truchas Mountain (13,275 ft.), and Santa Fe Baldy Peak (12,661 ft.).

In Canada the term Rocky Mountains may be considered as covering the whole of the western highlands. There the mountains have a more rugged and Alpine character than in the United States, with numerous glaciers. The chief ranges and peaks are the Saint Elias Range (Mount Logan, 19,539 ft.) near the Alaska frontier, and Mount Robson (13,500 ft.) farther south.

RODENTS. By far the largest of all the orders of mammals in point of numbers is that of the rodents or gnawing animals. It contains about 2,000 species, distributed in nearly all parts of the world, and embracing such familiar animals as squirrels, hares and rabbits, rats and mice, gophers, porcupines, and beavers. All rodents have broad chisel-like incisor teeth adapted for gnawing. There are no canine teeth, and so a gap occurs between the incisors and the molars, or grinding teeth. The incisors keep constantly growing from the roots as fast as they are worn away from the top, and the lower jaw is so hinged as to allow not only an up-and-down movement but also backward-and-forward and sidewise motions as well.

Most rodents are small, the largest, the capybara of South America, being only the size of a half-grown pig; but they work mischief far out of proportion to their size, devouring field crops and food stores and some of them carrying dangerous diseases to man and other animals. Their habits of living are remarkably varied, some of them living in trees, some on the ground, some chiefly underground, and some chiefly in the water. Their food is principally vegetable matter. Some of them are valuable for their fur, notably the hare, beaver, the beautiful little squirrel-like chinchilla, and the coypu of South America and the West Indies from which comes the familiar nutria fur.

Despite their small size, the rodents have come to predominate over other groups of mammals because of their immense fecundity, their wariness, and their ability to get a living in places where other animals would perish. All the chief rodents are described in separate articles in these volumes.

RODIN (*rō-dăn'*), FRANÇOIS AUGUSTE (1840–1917). Sketching animals in the Paris parks at six o'clock of a morning; in drawing school from eight until twelve o'clock; eating a pocket lunch to get in a hurried noon visit to the Louvre gallery; clerking in the shop of an ornament maker all the afternoon; and in the evening more drawing, sometimes far into the night. This was the daily program of the boy Rodin, at 14 years of age.

A hard program for a boy, but out of it grew one of the greatest sculptors of all times. Fate generally evens things up, and through the poverty and hardship of his boyhood experience came the independence and courage that fitted Rodin to triumph over the criticism he was to encounter during most of his life. For Rodin did not follow the fashion of the day by creating idealized statues and sculptured groups that were merely graceful and pleasant to look at. Instead, he expressed in bronze and marble the sternness of life as it had come to him, as he had found it portrayed in gaunt lined faces about him.

To the storm of criticism from a public that found his work "ugly," this man from his own experience could answer, "Nothing is ugly that has life. Whatever suggests human emotion, whether of grief or pain, goodness or anger, hate or love, has its individual seal of beauty."

The First Great Success

Still poor and unknown, at the age of 37 Rodin succeeded in entering his statue, 'The Age of Bronze', in the salon exhibition of Paris. It was so realistically done that the entrance jury accused the artist of having molded the face in plaster from a living model, instead of modeling it by his art. This unjust accusation, as it turned out, brought Rodin both fame and friends. An artist member of the government heard of the charge and went to watch Rodin at work. He was so impressed at the rapidity and sureness of his modeling that he himself went to the jury of the salon, declaring that 'The Age of Bronze' was only one example of the realistic workmanship of this unknown artist. He convinced the jury, and the much-discussed statue was bought by the state and placed in the Luxembourg Gardens. After this Rodin was no longer unknown. The unjust accusation had brought him before the public in a way that praise would not have done, and had given him friends that were to be his for life.

SAID RODIN: "NOTHING IS UGLY THAT HAS LIFE"

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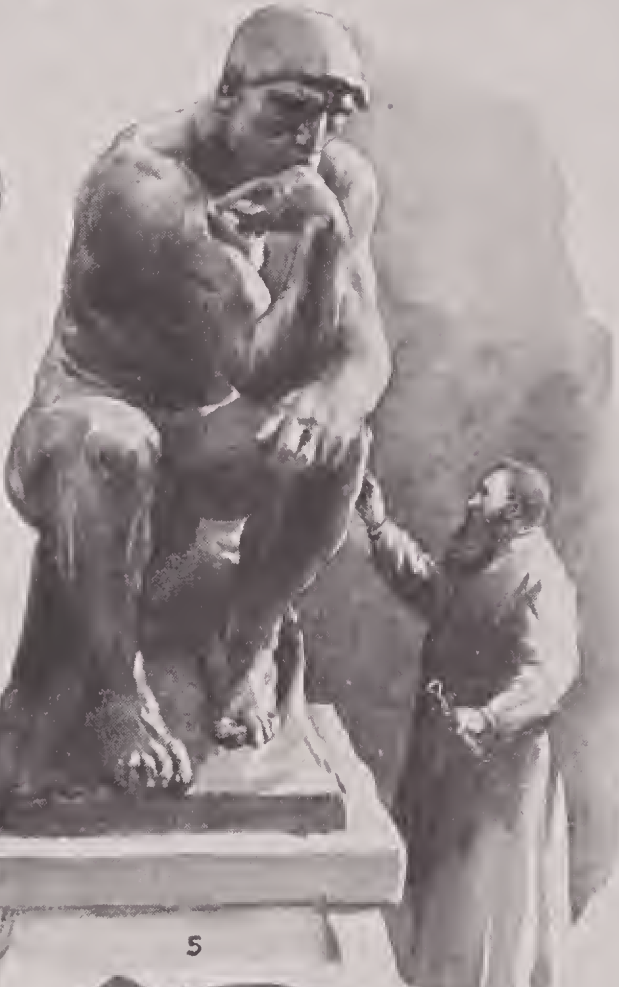
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Rodin believed that "whatever suggests human emotion, whether of grief or pain, goodness or anger, hate or love, has its individual seal of beauty." This belief gave all his work an intense spiritual quality, which, together with his marvelous technical skill, characterizes every piece of work from his hands. Once he had given to the material its spiritual quality, he ceased work on it, and many of his figures rise half-made from a rough-cut block of marble. The sculptures on this page include his best-known work: 1. 'Madame V'. 2. 'The Burghers of Calais'. 3. 'John A. J. Falguiere'. 4. Part of statue to Apollo. 5. 'The Thinker', by many considered Rodin's greatest work. 6. 'Balzac'. 7. 'St. John the Baptist'. 8. 'Thought'. 9. 'The Age of Bronze'.

But until he was 50 years old, Rodin lived and worked in poverty. Almost every creation that came from his studio was received at first with active disapproval, followed by curiosity, half-recognition, and finally enthusiasm. Rodin's was a long and hard probation. "I never knew," he said, "what encouragement meant. The little terra cotta heads and figures I put in the shop windows never sold. Yet at my work I was never sad, I always had pleasure in it."

In addition to works expressing pain and despair, he has given groups that throb with joy and ecstasy. He did many unusual things. One of the most striking was to leave his figures half cut from the marble. In many, such as 'The Broken Lily', 'Thought', and the monument to Victor Hugo, the unfinished figures seem to rise from the block, and yet no line is lacking to leave the impression perfect.

When Rodin was 76 years old he deeded to the French government the entire collection of his own works and other art objects he had acquired, together with Maison Biron, his famous Paris studio. This is the only museum in the world where a sculptor's masterpieces are to be seen as placed by their creator. Here art lovers from all parts of the world go to study his work. No artist of the century is more widely known, more critically discussed, or more generally honored.

Rodin never acknowledged any work as his masterpiece, but the 'Burghers of Calais' in its intense naturalism and dramatic energy is the culmination of his genius. The monument to Balzac shows the eccentricity of Rodin. Several small groups such as 'The Kiss', 'Eternal Spring', show the artist in his expression of the beautiful. The statues 'John the Baptist', 'Eve', and 'The Age of Bronze' are familiar wherever art is appreciated. The well-known 'Thinker' is from the unfinished 'Portal of Hell'.

Few important galleries are without examples of Rodin's art. The Metropolitan Museum of New York City has 21 pieces of statuary, besides studies, drawings, and casts. There may be seen the 'Bather', 'Cupid and Psyche', and the symbolic piece named 'The Hand of God'.

RO'LAND. Among the Basque mountaineers of the Pyrenees the story still runs that on stormy nights among the mountain crags can be heard the ghostly echoes of the horn sounded centuries ago by Roland, the legendary hero of Charlemagne's army, as he lay dying at Roncesvalles (French Roncevaux), after holding in check the vast army of the Saracens.

There have been so many tales told of Roland it would be difficult to choose the most interesting. In the Middle Ages the minstrels sang of him at castle firesides while the winter snows drifted outside, and in battle the defeated troops rallied again to the charge when they heard the glorious deeds of Roland chanted before them. The best known of all these stories were gathered into one great epic poem called the 'Song of Roland'. This has been translated into many languages and sung from sunny Italy to far-away Iceland. Famous poets have written about the hero's adventures.

The legend of Roland is based on authentic history. Charlemagne, who is said to have been the hero's uncle, was fighting the Saracens in Spain in the year 778, when he was recalled by a report of disturbances at home. As he crossed the Pyrenees, the rear guard of his army was cut off and destroyed in a narrow defile by the savage Basques of the mountains. Historians of the time tell how Count Hruodland or Roland of the Breton March was among those killed.

The Glories of the Legend

This massacre was made the basis for the heroic legends of Roland. In the 'Song of Roland' poetic imagination has transformed the Basques into a Saracen army of 400,000 men, whom Roland and his followers held at bay.

The armies clashed with cries and shouts, the whizzing of darts and hissing of arrows, wrote the poet. The battle-cry of the Franks sounded high above the confusion. Roland was ever in the forefront of the battle. His sword, Durendal, cut down the bravest and strongest of the enemy, and his powerful war-horse trampled the turbans of the Moors under its hoofs. His brother-in-arms, Oliver, called to him to summon Charlemagne's aid by sounding his horn, but he refused and the battle went on fiercer than before. But there was no resisting the overwhelming numbers of the enemy. One by one the dauntless knights fell fighting, and soon only a few remained alive. Then Roland, knowing that death was near, raised his horn to his lips and blew a mighty blast.

Now this horn, or oliphant as it was called, had been a gift from the King. Only Roland of all the knights was strong enough to sound it, and so wild and sweet and penetrating was its note that on hearing it birds fell from the trees, the ground shook, chimneys fell from the houses, and people cried out with their fingers in their ears. Only in deadliest peril would Roland sound his horn. But now—

Roland raised to his lips the oliphant,
Drew a deep breath, and blew with all his force,
High are the mountains, and from peak to peak
The sound re-echoed; thirty leagues away
'Twas heard by Carle and all his brave compeers.
Cried the King: "Our men make Battle!"

The Death of Roland

At once Charlemagne turned back, but it was too late. All of the little army was slain and Roland was dying.

The Count Roland feels through his limbs the grasp
Of death, and from his head ev'n to his heart
A mortal chill descends. Unto a pine
He hastens, and falls stretched upon the grass.
Beneath him lies his sword and oliphant,
And towards the heathen land he turns his head,
That Carle and all his knightly host may say:
"The gentle Count a conqueror has died."

So in the sad Pass of the Roncesvalles perished the mighty Roland, the hero of the Franks.

ROLAND (*rō-läṅ'*), MADAME (1754–1793). "O Liberty, what crimes are committed in thy name," cried this eminent Frenchwoman, and bowed to the clay statue of Liberty standing near the guillotine. Then placing her head on the block, she paid with her life for her opposition to Robespierre, Danton, and their fellow Terrorists of the French Revolution.

As a child in Paris, Marie Jeanne Philipon—as she was then named—was a great reader, devouring all that came her way, and the reading of Plutarch made her a republican. In 1780 she married Jean Marie Roland, a government official who afterwards became a leader of the Girondist party. When the Revolution came, Madame Roland, with her masculine intellect and woman's heart, became the queen of a coterie of young and eloquent enthusiasts in Paris, who professed moderate republican views and opposed the excesses of the more radical party. The frequenters of her drawing-room included not only all the famous and ill-fated leaders of the Gironde, but at first even Robespierre and Danton, leaders of the Jacobins, were of her circle.

When the Girondists fell, because of their protests against the "September massacres" and their attempt to guide the Revolution in moderate courses, her husband escaped from Paris to safety. Madame Roland was arrested and spent months in prison before death closed her tragedy of life; it was during this time that she wrote her unfinished 'Memoirs'. Her character took on a new refinement through suffering; in Carlyle's phrase, "like a white Grecian statue, serenely complete, she shines in that black wreck of things." On Nov. 8, 1793, she was carried to the guillotine along with a trembling printer, whom she asked the executioner to take first in order that her fellow victim might be saved the horror of seeing her head fall. A week later her husband died by his own hand near Rouen, unwilling to live longer in a world of violence and disorder.

ROMANCE. In the Middle Ages the nobles of Europe lived in lonely castles, usually perched in some inaccessible position; and no less lonely was the life of the people within. There were few books to read and fewer who could read them. Travel was hazardous and rarely undertaken except for a pilgrimage or a crusade.

In such a life one can understand that visitors were eagerly welcomed. Peddlers, jugglers, mountebanks of all sorts, were constantly being entertained. Most welcome of all was the minstrel or singer, who was called a *trouvère* in northern France and a *troubadour* in the south. Lord and lady, children and servants, would gather around the fireplace of the great hall to hear the minstrel chant his thrilling tales of love, of war, and of mighty deeds. Through his songs ran the spirit of chivalry, the social ideal of the feudal age. (*See* Feudal System; Knighthood.) Chivalry taught knights to defend the church, to make war against the infidel unceasingly, to be courteous, and to keep their word no matter what difficulties arose.

Around these ideals, and around the stories of history and legend which exemplified them, the minstrel built his lays. They were called "romances" because the minstrels used one of the "Romance" languages—that is, languages derived from the old Roman or Latin tongue. (*See* Romance Languages.)

The theme of all these early romances is a quest or search. Whether it is the Holy Grail the knight is seeking, or a lost mistress or mother or father; whether he is seeking forgiveness for a sin or for lack of faith in his lady; or whether he is merely seeking adventure for its own sake—there is always a quest.

The people of the Middle Ages loved to hear of heroes of their own as well as of other lands and times. In France they wanted to hear of Charlemagne, the great king who had conquered barbarian and Saracen (*see* Charlemagne). They liked to hear of his nephew, the legendary Roland, who had died fighting bravely against such great odds (*see* Roland). Other cycles of stories grew up about King Arthur and the Knights of the Round Table, various heroes of the Crusades, and Alexander the Great.

Stories that Grew with Age

These bright romances grew sometimes to enormous length, as singer after singer embellished the tales handed down by word of mouth and added new episodes in response to the eager demands of his listeners. At first such tales were nearly all in verse, but later prose stories began to appear. An immense body of these romances still exists, written down by various singers and later collected.

To modern taste many of these romances seem fantastic or childish stories, strung loosely together at tiresome length. Yet there is hardly one without its elements of charm and passages of striking beauty. 'Amadis of Gaul' is one of the most interesting. Whether the original of this story was French, Spanish, or Portuguese no one can decide; but it is, as someone has said, "the prose epic of feudalism." The adventures in this 14th century story range from Scotland to Turkey, and giants, enchanters, and magic chambers fill it with amazing incidents. Although Cervantes wrote his 'Don Quixote' especially to ridicule the old romances, he declared that 'Amadis of Gaul' is "the best of all books of this kind that have ever been written."

To English readers the most important group of romances is that dealing with King Arthur and the Knights of the Round Table, and the search for the Holy Grail (*see* Arthur, King; Grail, The Holy; Round Table). In prose form the legends of Arthur are preserved in the famous work of Sir Thomas Malory, 'Morte d'Arthur', and in poetry they have been adapted by Tennyson, Swinburne, and other poets. In fact, the Arthurian legends have served as the richest storehouse of romance from which the English poets have drawn. Perhaps even more important is the fact that these medieval romances contain the germ from which the modern novel has sprung, and that the name has been retained to denote the type of fiction in which the imagination is given free rein to deal with extraordinary events and characters of transcendent virtues and vices as in the stories of the Middle Ages. (*See* Novel.)

ROMANCE LANGUAGES. The French, Italian, Spanish, and Portuguese languages, different as they are today, are all direct descendants of Latin, the language of the Romans. When Roman colonists spread over Europe as far north as the German forests, they took their language with them. This common language of Europe underwent many curious and interesting changes when learning died out under the barbarism of the Dark Ages. Even in the days of the Roman Empire, the Latin spoken by the people in the various provinces varied considerably, and these differences, influenced by the native tongues of the conquered peoples, by racial character, by geography, and by many other causes, finally transformed the various dialects into languages so different that one who does not know Latin can hardly see any point of resemblance. This group of languages is called the "Romance" group from the fact of their common descent from the Roman tongue. Because they are all derived from Latin, a knowledge of Latin is a great help in learning them. In addition to the four languages mentioned, the Romance group also includes Rumanian and several minor tongues, including a French dialect called Provençal, which was formerly spoken in the south of France and was chiefly used by the troubadors or medieval minstrels.

HOW ROME WON and LOST the WORLD

ROMAN HISTORY. When the curtain rises upon the pageant of Roman history, it discloses the destined mistress of the world a tiny settlement on the Palatine hill, one of the famous seven hills, about 17 miles from the mouth of the Tiber, in central Italy. At this point the river was easily fordable and so merchants from the south had settled here to trade with the powerful, wealthy, and more civilized Etruscans who occupied the lands to the north. The settlement of the Palatine was made by men known as "Latins," who dwelt in the little plain of Latium (the modern Campagna). On the nearby hills were other settlements, the most important of which seems to have been made by Sabines. They, like the Latins, were one of the Italic peoples which had pushed down from the north about 1000 B.C. and conquered the original inhabitants of the peninsula, a dark people of the so-called "Mediterranean" stock. Another branch of the great Indo-European stock had invaded Greece at about the same time. (*See* Etruscans; Races of Mankind.)

The various settlements on the seven hills finally joined to make one city, with common laws, social organization, and religion. At first the Latin chieftains

AT THE CENTER OF ROME'S LITERARY CIRCLE

Vergil is reciting a poem, perhaps one of the Georgics, in which he celebrates the husbandman, or a part of the Aeneid, written to the glory of Rome, while laurel-crowned Horace awaits a chance to read an ode or two. The bald-headed man at the right is Maecenas, a lover of the arts and letters and a generous man of wealth whose name has ever since been a synonym for a patron of poets and painters.

ruled, but before long—perhaps as early as 750 B.C. —the community fell into the hands of Etruscan princes from across the Tiber. Under their enlightened though despotic rule Rome grew steadily in importance and power, and great temples and public works were constructed, notably the huge sewer, the *Cloaca Maxima*, which stands to this day. After about two and a half centuries, however, their cruelty and tyranny caused a revolt which resulted in their expulsion. From that day the name of "king" remained so hateful to the people that even the most despotic of rulers in the later days of the Roman Empire never dared assume the title.

At first the Romans had no written records, and the traditions of their early history became so intermingled with fable that historians have difficulty distinguishing fact from fancy. These legends tell how Romulus ruled for 37 years after he founded the city in 753 B.C. (*see* Romulus); and how he was followed by Numa Pompilius, a wise and pious ruler who, under the guidance of his wife, the nymph Egeria, is said to have taught the Romans the arts of peace and the worship of the gods. Under his successor, Tullus Hostilius, the Romans conquered Alba Longa, the religious center of the Latin people. In this war took place the famous contest between the Horatii and the Curatii, three brothers from the opposing sides who were selected to decide the struggle by personal combat. The Roman champions won, and not long afterward Alba Longa was destroyed and its people moved to Rome. During the reign of Ancus Martius, the next king, many troublesome Latin cities were conquered and their inhabitants brought to Rome. This ruler is said also to have built Rome's seaport Ostia at the mouth of the Tiber.

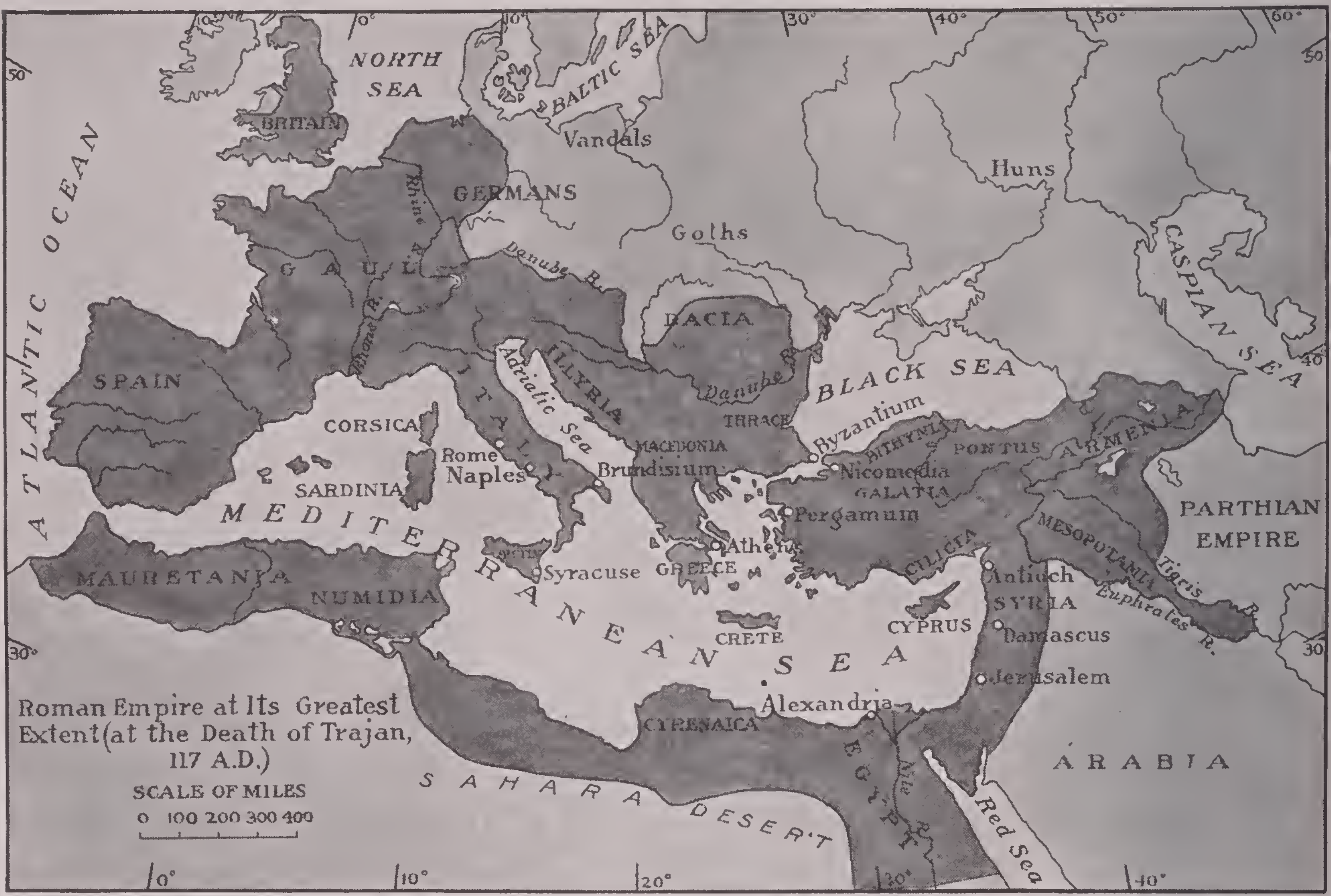
Rome Becomes a Republic

Tarquinius Priscus, the first of the Etruscan kings, drained the city, improved the Forum, the commercial and political center of the town, founded a temple to Jupiter, and carried on many wars with the neighboring peoples. Under Servius Tullius, the sixth king, a treaty was made with the Latin cities acknowledging Rome as the head of all Latium. Servius Tullius enlarged the city, the story goes on, and built a wall around all seven hills. The last of the kings, Tarquinius Superbus, was a tyrant and oppressor of the people. He scorned religion, but was induced to buy the famous Sibylline books that thereafter were the chief guidance of Rome in the hour of need (*see* Sibyls). A rebellion against him was led by Junius Brutus, who drove him from the throne (510 B.C.). Rome now became a republic.

Four times the banished Tarquin attempted to regain his power. First, he enlisted the aid of Brutus' two sons. When their treachery was discovered, the stern old father, true to the ancient Roman ideal of duty, condemned them both to death. Next, the men of Veii and Tarquinii, two Etruscan cities, marched on Rome to force Tarquin's restoration. Brutus was slain in the fight, but the Romans won the day. Next, Lars Porsena, an Etruscan prince, seized a height across the Tiber from Rome. The city was saved only by the heroism of Horatius and two companions, who held off the whole Etruscan army while the Romans destroyed the bridge (as you may read in the story accompanying the article on Tiber River). Finally Tarquin stirred up his son-in-law, Octavius Mamilius, chief of all the Latins, to lead a revolt. But the Latins were crushed in the famous battle of Lake Regillus, in which, the story goes, the Romans were aided by Castor and Pollux.

The young republic which now set out on its long career of almost incessant warfare was far different from the great republics of today. It was only a tiny city-state, much like the city-states that were flourishing at the same time in Greece. Its area was less than 400 square miles and its population perhaps 150,000. Chief power was in the hands of the wealthy and aristocratic citizens, called the "patricians," who were supposed to be the descendants of the three original tribes of Rome. The common citizens, the "plebs" or "plebeians," at first had little more to do with the business of government than they had had in the days of the kings. But bit by bit they tore down the barrier which separated the two orders, and the internal history of the republic for the next three centuries is largely the story of how the plebeians wrested reform after reform from the patricians.

WHEN ROME WAS MISTRESS OF THE WORLD



As your eye travels along the shaded portions of the map girdling the Mediterranean, it takes in virtually the whole of the ancient civilized world. From the Atlantic to the Caspian, from Britain to the Red Sea, from beyond the Rhine and the Danube to the deserts of Africa, a hundred million souls, perhaps, in Europe, Asia, and Africa, were bound together in a far-flung empire such as the world was not to see again until the rise of the British Empire.

In the early days of the republic the ruling power was divided between two patrician magistrates, elected for one year. These were the "consuls." The assembly in which they were chosen (the *comitia centuriata*) was made up of divisions apportioned in such a way that votes of the patricians counted for much more than those of the far more numerous plebeians. The Senate, the most important political body, consisted of 300 men chosen by the consuls from the patricians. Thus shut out from office and political power, the plebeians were grievously oppressed by their wealthy fellow-citizens. True, they were protected from the worst dangers of arbitrary power by the *lex Valeria* (Valerian law) passed in 509, which provided that whenever the life or rights of any citizen were at stake, he could appeal from the

HEROIC FIGURES IN THE HISTORY OF ROME

1. Hadrian, an emperor whose reign was the most splendid era of Roman architecture. 2. Cicero, orator, philosopher, man of letters, statesman. 3. Hannibal, greatest of all Carthaginian generals, and the most formidable foe that ever threatened Rome up to the day of its downfall. 4. Trajan, the soldier-emperor under whom the Roman Empire reached its greatest extent. 5. Julius Caesar, orator, soldier, empire-builder, "the noblest Roman of them all." 6. Augustus, the heir of Caesar and the first emperor in name. 7. Scipio Africanus, great general, victor at Zama over Hannibal.

magistrates to the assembly of the people. But they suffered from unjust debt laws and from unfair distribution of the "public lands"—the territory won by conquest.

When a Whole Nation Went on Strike

To redress their wrongs the plebeians resorted to what might be called a "general strike." In 494 B.C. they marched out of Rome in a body and threatened to make a new city. The "first secession" so terrified the patricians that they agreed to cancel all debts and release those imprisoned for debt. Furthermore the plebeians were granted the right to be represented by new officials, called "tribunes," who should have the right to veto the act of any magistrate which bore unjustly on any citizen.

From this beginning, the plebeians went on to gain other rights. They soon won recognition for an assembly of their own (the *concilium plebis*), and forced the appointment of a commission of ten men (*decemvirs*) to put the laws of the state in writing and have them engraved on 12 tablets of bronze (450 B.C.). They gained the right of intermarrying with the patricians (*lex Canuleia*, 445 B.C.) and obtained admission to the various public offices one after another. The chief of these, which were established to relieve the consuls of the growing burdens of administration, were those of *quaestors*, or treasurers; *censors*, who kept the lists of the citizens, assessed taxes, and supervised public morals; and *praetors*, or judges. The struggle was long drawn out, and it was not until 367 that it was decided that one of the two consuls should be a plebeian. In 350 the plebeians were admitted to the dictatorship, which was an extraordinary magistracy whereby supreme power at critical times was given to one man (*see* Cincinnatus).

Admission to these offices carried with it admission to the Senate, since vacancies were filled from those who had last been elected to public office. The Roman Senate of the republican period has been called the "most distinguished and important political body which has ever existed in the world." Its members were appointed for life, and executives were bound to submit to it all important measures. In theory it was a purely advisory body, but since its members were ex-magistrates, representing the highest ability and influence of the state, any advice it gave was almost certain to be accepted, for no magistrate would dare challenge such a body unless he was prepared to back up his act by force of arms.

The growing power of the plebs was marked by the gradual rise of a new voting body, the *comitia tributa*, in which one man's vote counted for as much as another's. This developed from the plebeian assembly (*concilium plebis*, which still continued to meet) by allowing patricians also to participate. After the passage of a law (*lex Hortensia*) in 287 B.C. making the acts of the plebeian assembly binding on all the people, these two bodies made most of the laws.

The Struggle between Rich and Poor

Side by side with the struggle for political power went on the economic struggle between rich and poor. The wealthy landowners continued to increase their estates, appropriating the best of the lands and increasing their herds until they monopolized the public pasture. They continued the practice of lending money at ruinous interest to the small proprietors, reducing them to slavery when they could not pay. Moreover, the population of Rome was increasing too fast, and the soil was becoming poorer because of the primitive farming methods. The burden of constant warfare fell most heavily on the plebeians, who had to leave their little farms to fight the state's battles. Gradually, however, reforms were forced through, chief of which were the Licinian laws of 367, which again revised the debt laws, limited holdings to 300 acres, and compelled the large landowners to employ a certain proportion of free laborers.

While these momentous changes were taking place at home, the little city-state had been gradually extending its power. Compelled at first to fight for its very existence against powerful neighbors, Rome gradually fought her way to the leadership of the Italian peoples and so paved the way that was to lead to the conquest of the world.

The most formidable of its early foes had been the Etruscans. With their greater numbers and superior civilization, the Etruscans would probably have reduced Rome to vassalage but for the destruction of their fleet in a war with the Greek city of Syracuse in Italy (474 B.C.), and the constant pressure of the Gauls from the north who swarmed into the Po valley toward the end of the 5th century and laid waste the Etruscan cities of the north. Thus aided, the Romans had finally been able (396 B.C.) to take, after a ten years' siege, the powerful Etruscan stronghold of Veii, eight miles from Rome.

When the Gauls Sacked Rome

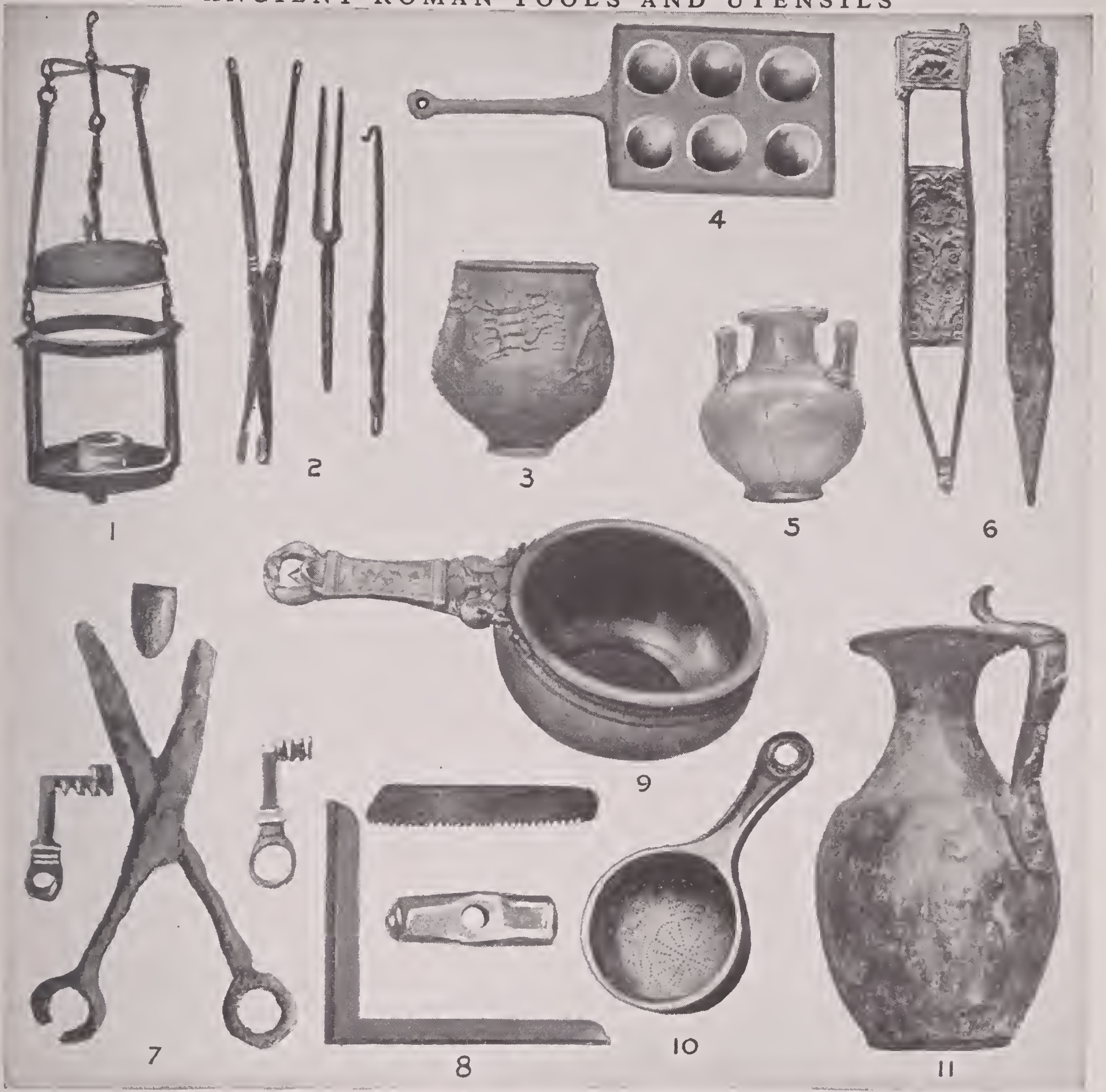
In its conflicts with this foe and with neighboring Italic tribes (chiefly the Aequians and Volscians), Rome was supported by the other Latin cities to the south which were united under the name of the Latin League and had made a treaty with Rome for mutual defense. The victorious progress of Rome received a temporary setback in 390, when wandering Gauls advanced through the heart of Etruria, laying waste the land as they went, and captured and sacked Rome. Legend tells how the garrison on the Capitol Hill was aroused in the nick of time by the cackling of the sacred geese, and repulsed the storming party. After a fruitless siege the Gauls accepted a heavy ransom and returned to the valley of the Po. Though Rome had been burned, the Etruscans had suffered far worse in the invasion and were so weakened that Rome was able to seize their southern possessions and in another century to conquer their whole territory.

Meanwhile the Latin League had become restive under the growing power and arrogance of their ally and attempted to break away from its control. From the two years' war which followed (340–338), Rome emerged victorious, reducing some of the towns to vassalage, giving others full Roman citizenship, and others partial citizenship (the "Latin right").

Another formidable foe in central Italy still remained to be reckoned with, the Samnites, who were also of Italic stock. The first conflict with this warlike people (343–341) had been interrupted by the Latin revolt. The truce then made was broken a few years later (326) and a desperate struggle continued, with interruptions, until the decisive battle of Sentinum (295) made Rome supreme over all central and northern Italy.

Only southern Italy, occupied by a disunited group of Greek city-states, remained independent. Its fate was not long delayed. Alarmed at the spread of Roman power, the Greek cities appealed to Pyrrhus, king of Epirus in Greece. He inflicted two telling defeats on the Roman army and then crossed to Sicily to aid the Greek cities there to throw off the yoke of Carthage. Encouraged by the arrival of a Carthaginian fleet, Rome renewed the struggle, and in 272 repulsed Pyrrhus in the battle of Beneventum (*see* Pyrrhus). One by one the Greek cities were taken, and Rome was mistress of all Italy.

ANCIENT ROMAN TOOLS AND UTENSILS



1. A Roman lantern found near Pompeii. 2. Medical instruments. 3. Pottery vase; showing typical ornaments. 4. Baking pan for small cakes. 5. A glass urn, to hold ashes of the dead. 6. Iron sword and bronze-plated scabbard, found in the Thames near London. 7. Scissors, thimble, and two keys. 8. Saw, hammer-head and T-square. 9. Skillet, found in England. 10. A strainer. 11. A bronze jug.

Nowhere did Roman genius shine with greater brilliancy than in the system which was gradually devised to weld these immense conquests into a contented and unified whole. Instead of treating the conquered cities of Italy as mere subjects, to be exploited for the interests of the conqueror, Rome granted many of them the privileges of Roman citizenship, in full or in part, as she had done with the Latin cities. Most of them were given the status of "allies," with self-government and the right to trade and intermarry in Rome, but not to vote. Furthermore all Italy was dotted with colonies of Roman citizens, most of whom retained their full civic rights. Considerable territory, nearly one-sixth of all Italy, was annexed and distributed among Roman citizens. Thus a common interest in the welfare of Rome was spread throughout the land.

Two centuries of warfare had now made Rome a nation of soldiers. Her only remaining rival in the western Mediterranean was the Phoenician colony of Carthage, which was the chief naval power as Rome was the chief land power. Carthaginian warships made the western Mediterranean a closed sea, and sunk the trading vessel of any other city which dared to bid for a share of the rich commerce of this region. Such a condition was intolerable to the pride of Rome, and a conflict for Mediterranean supremacy (the Punic Wars) began in 264 B.C., which continued with interruptions until Carthage was finally destroyed in 146. The courage and endurance of Rome were tested to the utmost in this "most wasteful and disastrous series of wars that has ever darkened the history of mankind." The war with Hannibal (the Second Punic War), one historian asserts, was "a trial such as no people has ever gone through before or since, and survived." But the stern devotion to duty, which was the keynote of Roman character, prevailed in the end, and after the battle of Zama (202 B.C.) Carthage was reduced to the status of a vassal state. Fifty years later, with savage vindictiveness, Rome again attacked her prostrate rival and razed the city (Third Punic War). (*See* Carthage; Hannibal.)

Winning World Mastery

Rome was now well launched on her way to world dominion. One conquest led to another. Upper Italy (*Gallia Cisalpina*), Sicily, Spain, Macedonia, Greece, and Asia Minor were subdued and made Roman provinces. Intoxicated with their sudden rise to imperial power, the new generation of statesmen departed from the wise policies of their great predecessors and gave themselves over to ruthless aggression and spoliation. Most of the conquered lands were administered by governors (*proconsuls*), who ruled like oriental despots with the sole aim of amassing in their one year of office wealth for a lifetime. Such enormous taxes were wrung from the subject peoples that they not only defrayed most of the expenses of the Roman state but enriched the greedy tax-farmers (*publicani*), who purchased the privilege of collecting the taxes. Wealth poured into Rome from the four corners of the globe, and the ancient simplicity of Roman life gave way to Asiatic luxury and pomp. Morals were undermined; vice and corruption flourished. The suddenly enriched officeholders acquired estates, buying up the little farms of the poor peasants, who could not compete with the hordes of slaves that worked the great plantations. The streets of the capital were flooded with a poverty-stricken rabble—ruined farmers, discharged soldiers, and idlers from all Italy—who lived on state and private charity and on bribes bestowed by office-seekers.

Between the aristocracy of birth and wealth and the vast moneyless mob there was bitter hostility. War of class against class was bound to come. A few patriotic statesmen tried to avert the dreadful climax, but in vain. The Gracchi brothers, grandsons of the great Scipio Africanus who defeated Hannibal at Zama, came forward as champions of the people and proposed laws to redistribute the public lands and to limit the powers of the corrupt and selfish Senate. Both fell victims to the hatred of their foes, Tiberius in 133 B.C., and Gaius 12 years later.

The death of Tiberius marked the beginning of a century of revolution and civil war that ended in the downfall of the Roman Republic and the establishment of the Empire. Henceforward armies, not votes, were to determine the course of events. First of the popular military chiefs was Marius, who had become a national hero by capturing Jugurtha, leader of an insurrection in Africa, and almost destroying (102–101 B.C.) a horde of German barbarians (the Cimbri and Teutones) who had disastrously defeated four Roman armies one after another. In the year 90 the Italian allies, who had long in vain demanded full Roman citizenship, rose in revolt (the Social War). The struggle lasted two years and ended in the bestowal of the rights demanded.

Rivalry between Marius and Sulla, an adherent of the senatorial party, for command in a war against Mithradates in Asia Minor led Sulla to march with his troops on Rome. For the first time Rome was invaded by a Roman army. As soon as Sulla and his legions were safely out of the way in Asia, Marius in turn seized Rome with his army and massacred many of the senatorial leaders. On his victorious return in 82, Sulla took a fearful revenge, slaughtering more than 5,000 of the people's leaders and confiscating their goods. As "perpetual dictator" (81–79) he passed laws transferring supreme power from the people to the Senate, but in vain; the aristocrats were too corrupt and feeble to keep the reins of power.

The history of the remaining years of the republic resolves itself into a series of biographies of the great adventurers who now made themselves masters of the town and disrupted state, sometimes joining hands to make their position secure, sometimes waging savage civil strife (*see* Caesar; Cicero; Crassus; Pompey). The only thing that saved the vast edifice of Roman power from crashing to final destruction was the emergence of two statesmen of commanding genius, Caius Julius Caesar and his great-nephew Augustus (Octavian), who scrapped the old republican framework, except in outward form, and remolded the tottering structure into an empire, in which all power was gradually concentrated in the hands of a single ruler, backed by the might of the Roman legions. How this was done is told in the articles on Julius Caesar and Augustus. (*See also* Antony; Cleopatra.)

Two Centuries of Peace and Prosperity

With the establishment of the empire, the century of civil strife, which had also seen almost constant warfare abroad, was followed by two centuries of profound peace broken only by frontier warfare. At home literature and civilization flourished, and in the provinces responsible men held power. More and more the Mediterranean world assumed the aspect of one great nation. Paved roads led from end to end of Italy, and into what are now France and Germany. Fragments of Roman roads still exist even in far-away Britain, aqueducts and bridges in France, and Roman wells in the Egyptian oases of the Sahara. Roman citizenship was extended to all free men throughout the empire and Roman law was administered in every court. In this period of tranquility, the new religion

THE ROMANS DEFY THE CONQUERING PYRRHUS

At the left is the ambassador sent by Pyrrhus to offer peace to the Senators, because he foresaw that it would be difficult to subdue the Romans, even though they had suffered heavy losses in the recent battle of Heraclea (280 B.C.). At first the Romans were inclined to welcome peace, but the aged Appius Claudius Caecus, the builder of the Appian Way, though so weak that he had to be carried into the Senate chamber, denounced the peace, and stimulated his fellow Senators to reply that Rome never negotiated with an enemy on Roman soil.

founded by Jesus of Nazareth had an opportunity to grow, slowly, but with comparatively little interruption, until in the reign of Constantine it became the official faith of the Roman Empire, and ultimately of the whole Western World.

But, though the "Roman peace" (*pax romana*) spread its beneficent aegis over the civilized world, though the remotest lands were ransacked to supply the wealthy citizens with luxuries and delicacies, though art and letters were prized and fostered, the national character was steadily decaying. Gone was the fundametal seriousness (*gravitas*) of attitude which marked all the conduct of Romans of the antique mold. Gone was the old reverence for the family, for the state, and for the gods. Prosperity had brought in the leaven of corruption. In place of a Brutus, offering up his sons on the altar of duty to the state, we find a Nero, murdering his mother and his wife at the prompting of a Poppaea. Selfishness had become the first law of life. The passion for a life of luxurious ease ruled in all classes. The rich amused themselves by giving feasts of unparalleled splendor; the poor had their *panem et circenses*—free bread and free shows. Slave labor had degraded the once sturdy peasantry to the status of serfs or beggars. The backbone of the nation, the middle class, had almost disappeared; there were only the very rich and the very poor. After the time of Diocletian the whole empire was put in leading-strings, and under the absolutism of one-man rule society became stagnant, politically, industrially, and mentally. Emperors could build up and maintain a bureaucratic organization of great efficiency, but they could not cure the cankers at the heart of the people.

The events of the imperial history of Rome need not detain us long. Augustus was followed by his stepson Tiberius (14–37 A.D.), a capable but unpopular ruler; then came the mad Caligula (37–41), whose life was ended by his own officers after he had reigned for only four years. Claudius (41–45) was not a strong ruler, but his reign left its mark on the history of the empire, for his generals conquered the southern part of Britain. The infamous Nero (54–68), was the last ruler of the line of Augustus, and his death ended the first century of peace (*see* Nero). For two years there were struggles for the throne between rival military commanders, and civil war was threatened, but with the triumph of Vespasian (69–79) the government again became stable. During the reign of Vespasian's son Domitian, a cruel half-mad tyrant, all Britain was conquered.

Domitian was followed by a line of five great emperors—perhaps the wisest and noblest line of rulers the world has ever seen. Nerva's brief reign (96–98) was followed by that of the great conquering emperor Trajan (98–117), under whom the empire reached its

A ROMAN FAMILY DINNER IN THE PERIOD OF DECADENCE

After Rome's conquest of the East, the sturdy simplicity that marked the Roman life of earlier times gave way to Oriental luxury and splendor. The women decked themselves in diamonds, pearls, and rubies from India and robed themselves in silks from China. Peaches, apricots, and other rare delicacies, then appearing for the first time in the Roman world, were brought at immense expense to furnish their tables. And, worst of all, her citizens became degenerate, like the corpulent gourmand at the head of this table.

greatest extent. Hadrian (117–138), first of the "Antonines," consolidated and improved the organization of the empire and fortified the frontiers, building the great wall across northern Britain, parts of which stand to this day. The period of his wise rule and that of the philosopher-emperors Antoninus Pius (138–161) and Marcus Aurelius (161–180) was pronounced by one great historian to be the happiest era in the entire course of human history, if the welfare of the great mass of the population be considered. (*See* Marcus Aurelius Antoninus.)

After Marcus Aurelius, the decline of the empire set in. The legions had found that they could make emperors at will from among their own numbers, and they set up 80 such soldier-made rulers in 90 years. The flood was at length stemmed by Diocletian (284–305), but he stemmed it at the price of turning the Roman state into an oriental despotism, abolishing the last pretense of republican liberty. The Senate was now no more than the city council of Rome. Diocletian also took the first step that ultimately led to the division of the empire, entrusting an associate, "Augustus," with the government of the West, while he himself ruled the East. The decline in the importance of Rome that began with Diocletian was consummated when Constantine moved his capital to the Greek city of Byzantium on the Black Sea (330 A.D.), renaming it in his own honor Constantinople (*see* Constantinople).

The transfer of the capital meant ultimately a division of the empire. The story of the Byzantine Empire is a long and glorious one, that of the Western Empire from this time on merely one of weakness and decline (*see* Byzantine Empire). Gradually the northern barbarians seeped into Italy and in 410 Alaric took Rome. The Western Empire from that time became the prey of successive waves of barbarians. (*See* Alaric; Goths; Huns; Lombards; Vandals.)

In 476 Romulus Augustulus, the last of the imperial line in the West, who combined in his name that of Rome's legendary founder and that of her first emperor, was deposed by the barbarian leader Odoacer. The Roman Empire was at an end and the barbarian kingdoms of the Middle Ages were soon to take its place. But in reading the history of France, Italy, and Spain, you will realize that the end of the Roman Empire was in a way only its beginning. These new kingdoms governed themselves largely by Roman law, spoke forms of Latin, and professed the Christian religion. Thus, even though the great empire decayed and fell, Rome had won a new spiritual dominion, for the new faith spread throughout the lands which the Roman power had brought together but could no longer hold, and the seat of the great pagan power became the head of the Christian church, the spiritual capital of Christendom. (*See also* Greek and Roman Art; Italy; Latin Language and Literature.)

The CITY of the CAESARS Past and Present

"All Roads Lead to Rome" Said an Ancient Proverb. This is One of the Most Famous of Them—the Appian Way

"THE grandeur that was Rome" was spread like a mantle over the civilized world when Christ was born; and today the ruins of the empire and the priceless treasures of Renaissance and modern art make this city of the Caesars and of the Popes one of the most fascinating of spots to the inquiring traveler. Only less important is its place as the bustling capital of the new and growing kingdom of Italy formed a few score years ago.

ROME. Rome is, in truth, the Eternal City; we may say of it that its past and its present and its future are one. Time rolls back in Rome as in a book. We walk on the very dust of Caesar, and every step we take is on historic ground. Fallen Rome, the Rome which ruled the world for 500 years and had an extensive empire before Christ was born, is 20 feet under us wherever we go. Caesar's palace, Peter's prison, Paul's lodgings—they are the foundations of the modern streets of Rome. The huge area of the Forum has been laid open; here and there elsewhere a fragment has been dug up or a cellar excavated, and every day men uncover bits of the old Roman empire. But it is only bits, and Rome must be razed to the ground if the wondrous things beneath it are to be revealed.

What these wonders are we know in part. There are no ruins in the world so thrilling. The difference between Egypt and Rome is that the interest in Egypt is historical, the interest in Rome is human. We know almost nothing of Rameses II; we know almost everything of Julius Caesar.

And Rome brings Caesar as near to us as Napoleon. We walk across the place where Caesar lived. We stand on the spot where he was stabbed by Brutus. From the only authentic statue of him, on the Capitol, we can walk down into the great Forum, and read Mark Antony's speech in the place where Antony spoke and where he burned his friend's body before the people. That is the human touch of Rome, the kind of thing possible nowhere else.

All travelers to Rome first come to the Capitol and the Forum; there is no other site on earth in which is concentrated so much of the vital history of the world. Out of the little narrow streets we come suddenly upon a great flight of steps, handsome and steep. We run up, past the ancient statues, past the milestone from the Appian Way—which Paul must have looked upon and said, "Still seven miles to Rome"—past the cage of living wolves kept there in memory of Romulus, into the Capitol square. Let us go first into the Capitoline museum, and spend five minutes in the most amazing portrait gallery to be found anywhere.

Here, in a little room no bigger than a dining-room, are the Roman emperors, with their wives and families and friends, imaged in marble by those who knew them. You feel here, as nowhere else, that these men were *real*, and you know what we mean when we say that Rome impressed its image upon the world for all time. For here is Rome; here are the Caesars. Here is Julius; next to him Augustus and his mother. Here is the great philosopher-emperor Marcus Aurelius as a boy, then as a man; then his wife, then his daughter, then her daughter's husband. Then his son and successor, the brutal Commodus, who was murdered, and the wife who murdered him. Here is Nero's mother, the shameless Agrippina the younger, who killed her second husband Claudius (also here) to make way for her son. Then Nero himself, who in turn killed his mother, and then his wife, whom he kicked to death before he killed himself. The best and worst of rulers that the world has ever seen—all are here!

We sit before these men, seeing their character and destiny in their faces. Surely they are the most thrilling marbles in the world. But we leave them, pass the statue of the 'Dying Gaul' in the next room, and come back to the square.

In the middle is the fine equestrian statue, in bronze, of Marcus Aurelius, the emperor and philosopher who lived before Christianity had made its way, and who might have changed the history of mankind if he had been born a little later. Among the faces that we meet in Rome are some that haunt us as we go about, and we never forget the face of Marcus Aurelius, or the half-sad thoughtful face of the young Augustus.

The Ruined Splendors of the Forum

Let us leave the Capitol and come down to the Forum on the other side. It is disappointingly small to the eye at first; but it grows and grows, and lengthens and lengthens, and widens and widens, until it is a very wilderness of doom. We must have in our minds a clear notion of what has happened in the Forum since the days when this place was the central architectural glory of the world. As the history of Rome was submerged by the coming up of other nations, so the very monuments of Rome were buried in the dust of centuries.

The palaces of the Caesars fell. Their temples broke in pieces, and hundreds of years of ruin left Rome a rubbish heap. Throughout the Middle Ages the buildings of ancient Rome were robbed of their beautiful columns and stones to build the frowning castles of prelates and princes, or their marbles were burned into lime, to make mortar for peasant dwellings. By the time the 12th century came, the place where these marvels had stood was an impassable wilderness of rubbish. Orchards and gardens sprang up where temples had been, and the avenues of triumphal processions were covered with teams of buffaloes and oxen. The peasantry grazed their cattle in the Forum; mechanics set up workshops here; and only a few tops of columns standing out from the earth suggested the wonders that lay beneath. The very name of the Forum was forgotten, and so little was to be seen that, at the beginning of the 19th century, Lord Byron wrote of what is now one of the highest columns in the Forum, and called it "the nameless column with the buried base."

That nameless column is named now; its base is revealed, and it stands in the center of the most remarkable excavations that the eye of man can see.

Stroke by stroke men have carried on these excavations, and the thought that comes is of the wonderful sight that Rome must have been in all its glory! If only we could take the lid off all that remains! Four street-levels have been found, and the levels of the streets of ancient Rome lie sometimes 24 yards down, and never less than 8 yards down, from the level of the streets today. Broken columns, ends of temples, beautiful porticoes, ruined halls, mosaic pavements, rostrums, altars, fountains, inscriptions, lines of broken statues, houses with three stories, steps leading down to cellars and up to churches, enormous walls of red brick stripped of their original marble, exquisite reliefs, triumphal arches—all stretching across the vast space which begins at the base of the Senators' huge palace and reaches to the arch erected by Titus after the destruction of Jerusalem, with the Colosseum and the Arch of Constantine in the background. On the right, high up like a ruin in the skies, is the palace of the Caesars.

The traveler is bewildered as he stands amid this ruin, and tries to picture what this place was like once upon a time. Here in the Forum, in the days when emperors walked about among the people, were 25 acres of halls and temples and triumphal arches; 1,200 marble columns and 1,000 colossal statues; miles of porticoes, shops full of treasures, galleries full of great pictures; the Senate House and the Archives of the Empire of the World.

And it was not a show, all this wonder; it was not only to look at, but to *endure*. It was a thing of beauty made to be a joy almost forever. So well did they build, these Romans, that columns stand today in the open streets of Rome where they were set up 2,000 years ago. So well they did everything that the great drains of the city—including the Cloaca Maxima, near the Forum—are still in use today. They are big enough, as a writer said 2,000 years ago, "for a hay-cart to pass through."

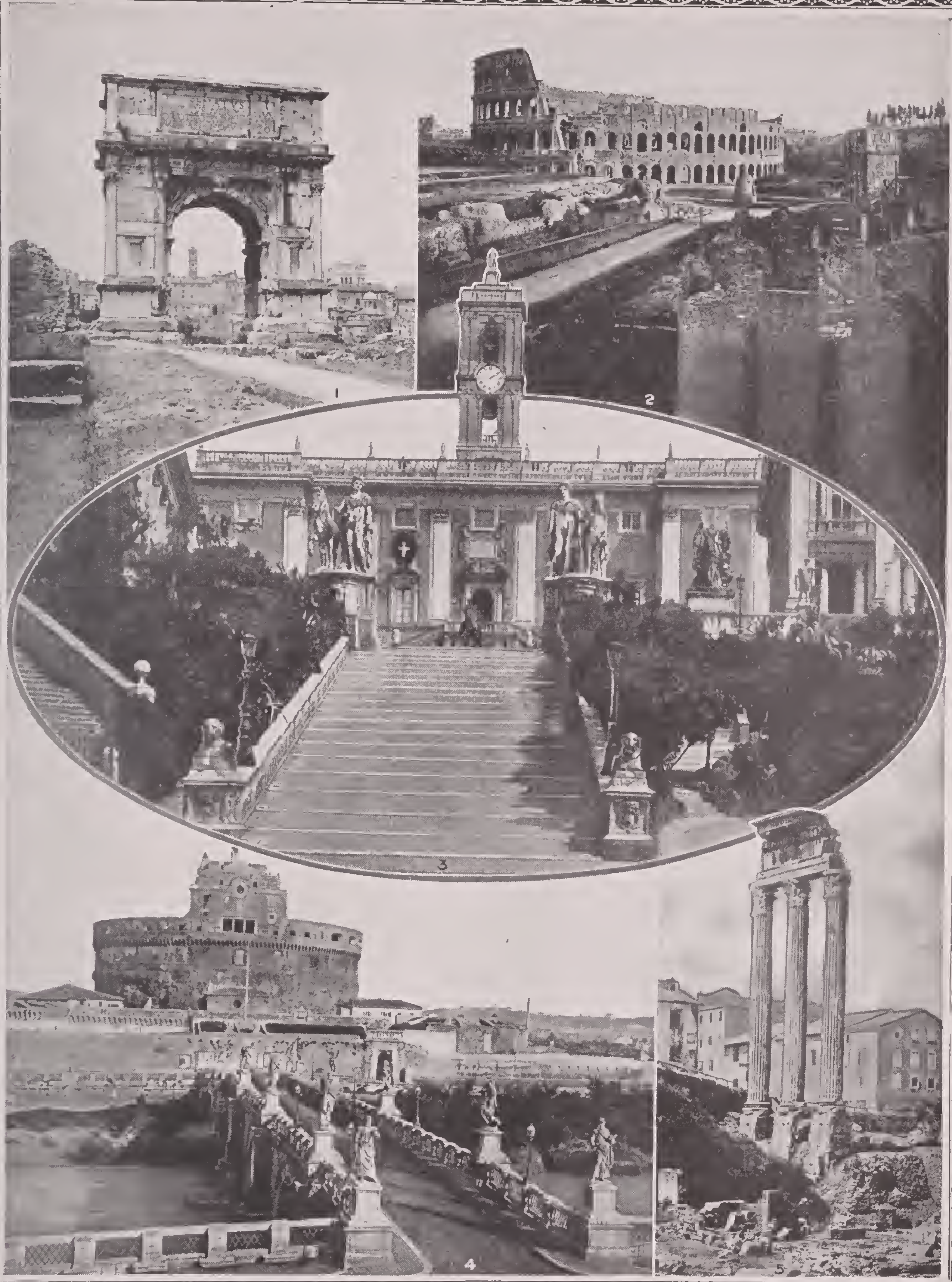
In this Forum where we stand, the history of Rome was made. It is almost true to say of Rome that *everything* happened here.

Imagination almost reels to think of the gigantic splendor of this place in days when Rome was Rome indeed. It is wonderful to see the vastness of the ruins; to go round to the left of the Colosseum and see it *whole:* then, walking slowly around, find that this great thing is a broken fragment!

Where Christians Fought Beasts

The mind simply cannot picture the Colosseum as it must have been when it was dedicated by the emperor Titus in 80 A. D., yet palaces and temples and tombs have been made of marble taken from this simple ruin. Twelve thousand captive Jews are said to have been engaged in building this huge place, of which the outside walls alone cost more than $50,000,000. Three times around the outside walls is a mile, and the walls rose high enough toward the sky to hold 20 tiers of seats for 80,000 people; and in the

SPLENDORS OF ROME, ANCIENT AND MODERN



1. The Triumphal Arch of Titus, conqueror and destroyer of Jerusalem. 2. The Colosseum, built in the reign of Vespasian, and long the scene of gladiatorial contests and other games; it could accommodate 80,000 spectators. 3. Palace of the Senators, which houses the civil administration of the modern city; its façade was built in 1591 from designs by Michelangelo. 4. Castle Sant' Angelo, built by Hadrian as a mausoleum, for fifteen centuries the fortress of Rome, connected with the Vatican by a secret underground passage, but now only a showplace. 5. Ruins of the Temple of Castor and Pollux, on the south side of the Forum.

midst of them, on a throne of ivory or gold, sat the emperor. A thousand beasts were slain in this arena to keep an emperor's birthday, and how many human death-cries have gone up from this place nobody on earth can know!

Once upon a time there were 400 kinds of plants among the ruins, and the first seeds of many of them may have come from the cages of wild beasts brought from distant lands. So that it is a thrilling thing to pull a leaf or to pick a flower that is growing here, for we hold in our hand a living thing that may go back to a great day at the Colosseum, when hungry lions were let loose on the early Christians "to make a Roman holiday."

Yet even the great Colosseum can never have seemed so dazzling to the Romans as the very ruins of it seem to us, for the world in which they moved was so luxurious that one of them wrote complaining that he could "hardly tread except on precious stones." A theater built for a ceremony of two or three days only is said to have been the greatest work ever made by the hand of man. It had three stories —one of marble, one of glass, and one of gilded wood; and the bottom story was supported by 360 marble columns, between which were 3,000 statues.

Gigantic Baths of Olden Days

There have been counted in Rome today 9,000 columns of marble still unbroken, and it is said that there must have been in former days 450,000 of these columns at least. Some which have been found were six feet across. We have only to walk into the baths of Caracalla, or into the baths of Diocletian just outside the railway station, to see how utterly words fail to describe the vastness of these buildings. Diocletian loved big things, and it is said that he set 40,000 condemned Christians to work laying out these baths, with their lovely mosaic floors and wonderful marble walls, to cover 400,000 square yards and to accommodate 3,000 bathers. Such was the splendor of Rome!

And while pagan Rome lived in pomp and splendor in the sun, her future conquerors were hiding underground. Down in the tombs were the persecuted Christians, driven to worship, and perhaps to live, among the dead. Forty groups of catacombs have been found outside the gates of Rome, cut out sometimes five tiers deep in the ground, so that we may walk about in them today at a depth of 40 feet below the surface, and walk so far in them that, if we went from end to end, we should travel more than 500 miles, or half as far as from Chicago to New York. Down in these tombs were the persecuted followers of the Carpenter of Nazareth, whose apostles had been led out of the gates to be crucified. The pagan Romans would have laughed if somebody had said that these poor men hiding underground were founding an empire greater than their own; yet today there are two things that take the world to Rome. One is the ruins of the emperors, the other is the monuments of the men they persecuted.

The great wonder that grows upon the traveler in Rome is the wonder of the Two Empires. Think of the fact that at one time there were in Rome on the same day two such men as Nero and Paul! Nero lived in a golden house; Paul was in chains. Yet Nero's empire has gone—you can hardly find a fragment of Nero in Rome today; he is the deadest of the emperors. Paul's empire has come, and it endures forever. Peter and Paul fill Rome today!

In the Steps of Peter and Paul

Few things can interest the traveler more than to go from spot to spot and hear the still small voice. You could hardly hear it in Rome 1,900 years ago. Go down into the catacombs, and realize that 1,900 years ago there were but a handful of Christians in Europe and that they had to hide down there! See their secret chapels, their graves, their paintings on the walls. The emperors were on the Palatine, in the Forum, at the Colosseum; the Christians, if they were not being torn to pieces by the lions, were singing in the catacombs.

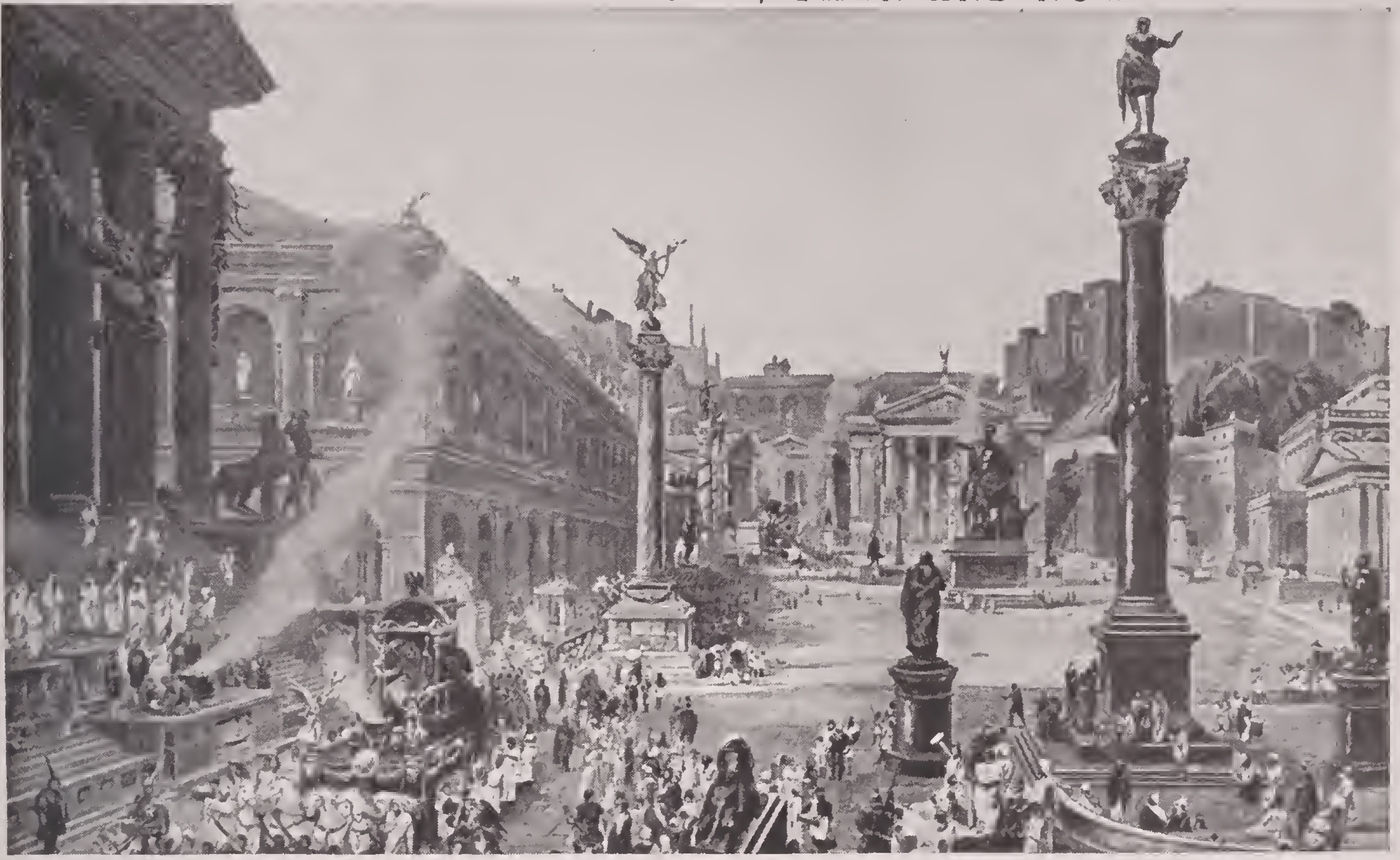
We follow Paul and Peter everywhere; stand where they stood, go into the house where, perhaps, Paul wrote his letter to Philemon; look over the house of Pudens, wonderfully well preserved. We ride along the Appian Way, by which Paul came to Rome—miles of it we ride along, between miles of broken tombs. We pass under the gate through which he walked to the place where he suffered death.

Strange is it to reflect that here was a great civilization *before* Christianity; that Christianity came into the very heart of it and was crucified; that the classical civilization ceased to be, the greatest power in the world broke down, and the persecuted Christianity inherited its greatness, establishing its empire throughout the earth for all ages to come, so that today, when the Caesars are so dead that men store coal in their palaces and drink liquor in their tombs, the great glory of Rome is the tomb of the fisherman Peter, whom Nero crucified!

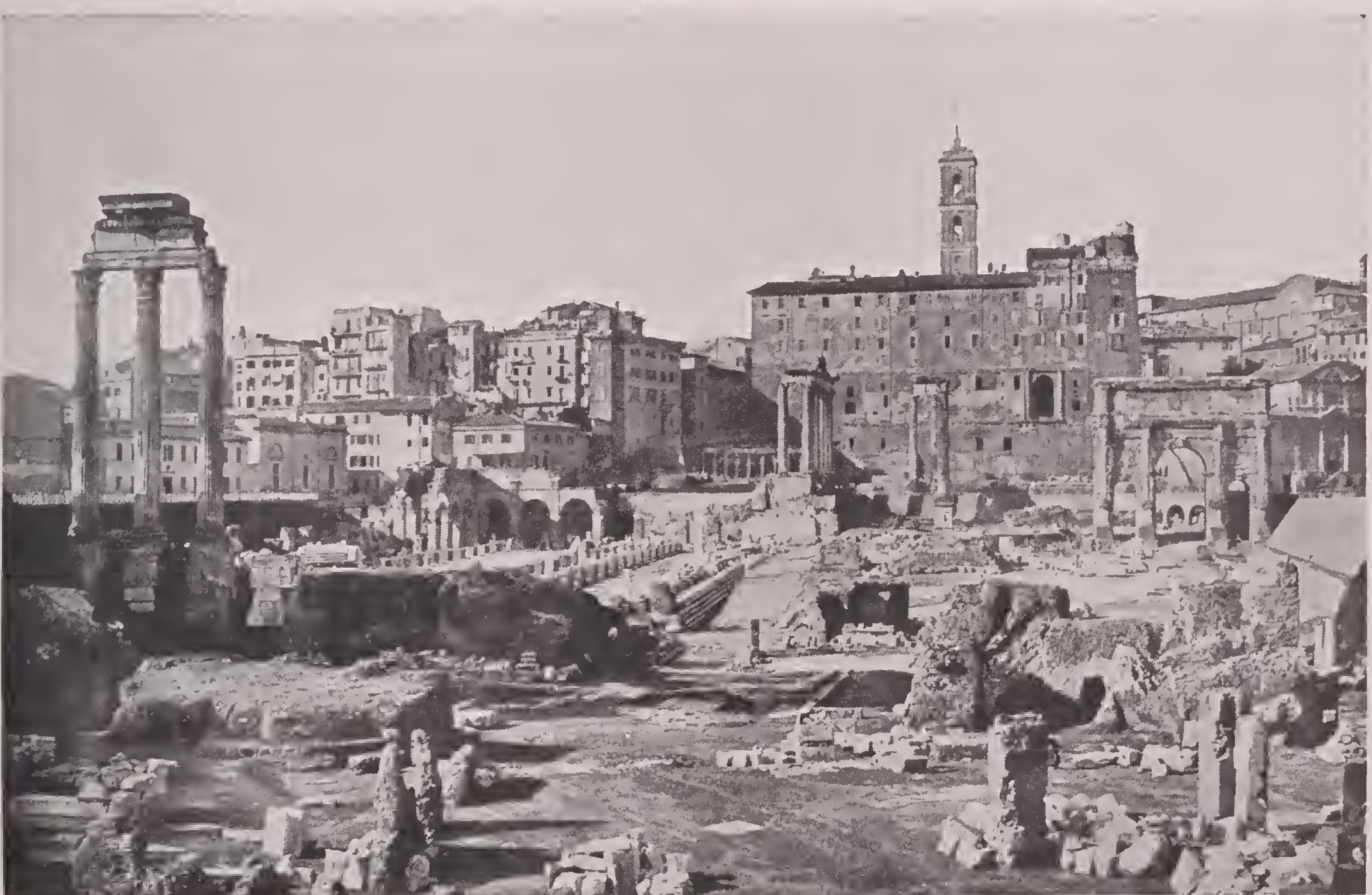
The Sublime "Jewel of Rome"

For St. Peter's is the jewel of Rome. We should be careful in calling a thing sublime, but St. Peter's *is* sublime. Out of a long mean street, we emerge into the vast square, where George Eliot felt that nothing small or mean could come. Everybody knows the picture of it, with the half-circle of high columns leading to the ends of the façade, about 150 yards in front of you. There are hundreds of these columns in four lines, and through the middle avenue a carriage and pair can pass. Each front column has a statue on the top. The vestibule is perhaps 50 yards long, and looking down from the ceiling are probably 20 statues, almost lost in the vastness, though they must be of enormous size. As we walk slowly toward the tomb of St. Peter, under the central dome, the beauty of the place grows upon us and becomes a dream; we lose the world of sense, and live as in a vision. Nothing but the sight of it can convey to us a sense of its great beauty.

THE FORUM OF ROME, THEN AND NOW



A famous painter has here rebuilt the Forum on canvas. The scene is the festival of Castor and Pollux, annually held on the anniversary of the battle of Lake Regillus. The Romans believed that the battle had been decided in their favor by the intervention of the twin gods. The temple dedicated to them (at the extreme left) was the scene of this yearly ceremonial.



Of the great buildings of the Forum only a few ruins remain, but even these have traces of their antique beauty. Finest of them are the three columns at the left, all that remains of the temple of Castor and Pollux. At the extreme right is the Arch of Septimius Severus and between them the open ground of the Forum, broken only by the fragments of statues.

Perhaps there is no dome like this anywhere. It is as light as can be, and its simple decorations—probably 80 pictures on a soft gold ground, in slanting panels—can be easily and clearly seen, though they are so high that the lettering has to be longer than a man, and a pen in St. Luke's hand is longer than St. Luke himself, in order that we may see it naturally.

Four huge pillars, each vast enough to occupy the space of a thousand standing men, hold up the dome, and around the church are a dozen other domes, over a dozen chapels, all bigger than the average church, and unspeakably more lovely.

And as we wander in this great place, seeming to grow more spacious and more lovely as we walk about it, we come to feel that it is one of the world's masterplaces. As one dome passes out of sight and another comes into view, as the rich gold of the great arches strikes the eye, as the great mosaics and frescoes come —one of them representing nine men's work for ten years, 90 years of human labor—as the white marble tombs loom before us, the great silence of the place growing upon us all the while, we are overwhelmed! Its size is stupendous—636 feet in length, while the tip of the cross on the huge dome is 435 feet above the ground. No wonder that after Pope Julius ordered it built in 1506, it took 126 years to carry out the plans!

The Wonders of the Vatican

Yet this marvelous place is only part of a place; it is only one part of the greatest building in the world today—the Vatican. If the Vatican stood alone in a desert, men would build a railway to it. It is, of course, the wonder-house of the world, as full of priceless treasure as the sea is full of salt; yet it stands not alone in its glory, but here in Rome among a thousand wonders. It is the greatest palace and the greatest church on the face of the earth.

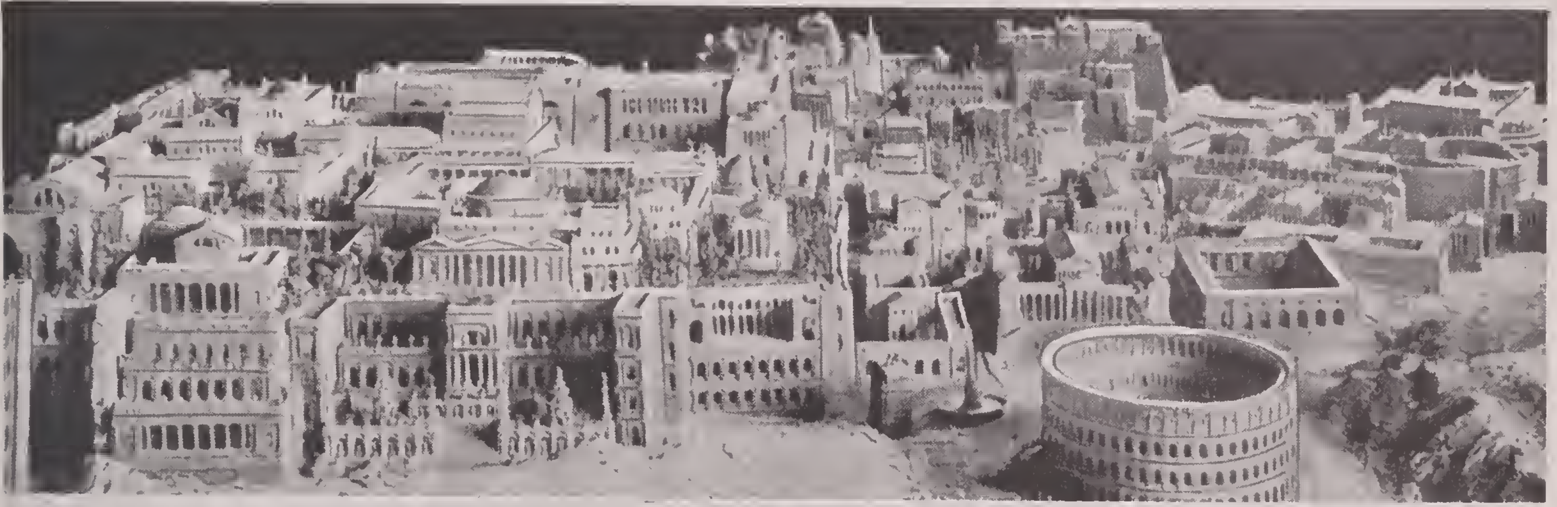
It covers more than 13 acres. It is said to have a thousand halls and chapels and apartments, and on one ceiling alone Michelangelo gave up four hard-working years of his life. Whether this roof, or a roof that Raphael painted, is the greatest thing in art is an endless controversy among those who understand these things; but the Vatican will not be jealous whichever way the problem is decided, for both these roofs are here within its walls. Here Raphael painted for 12 years; here Michelangelo must have chiseled and painted for most of his long and glorious life.

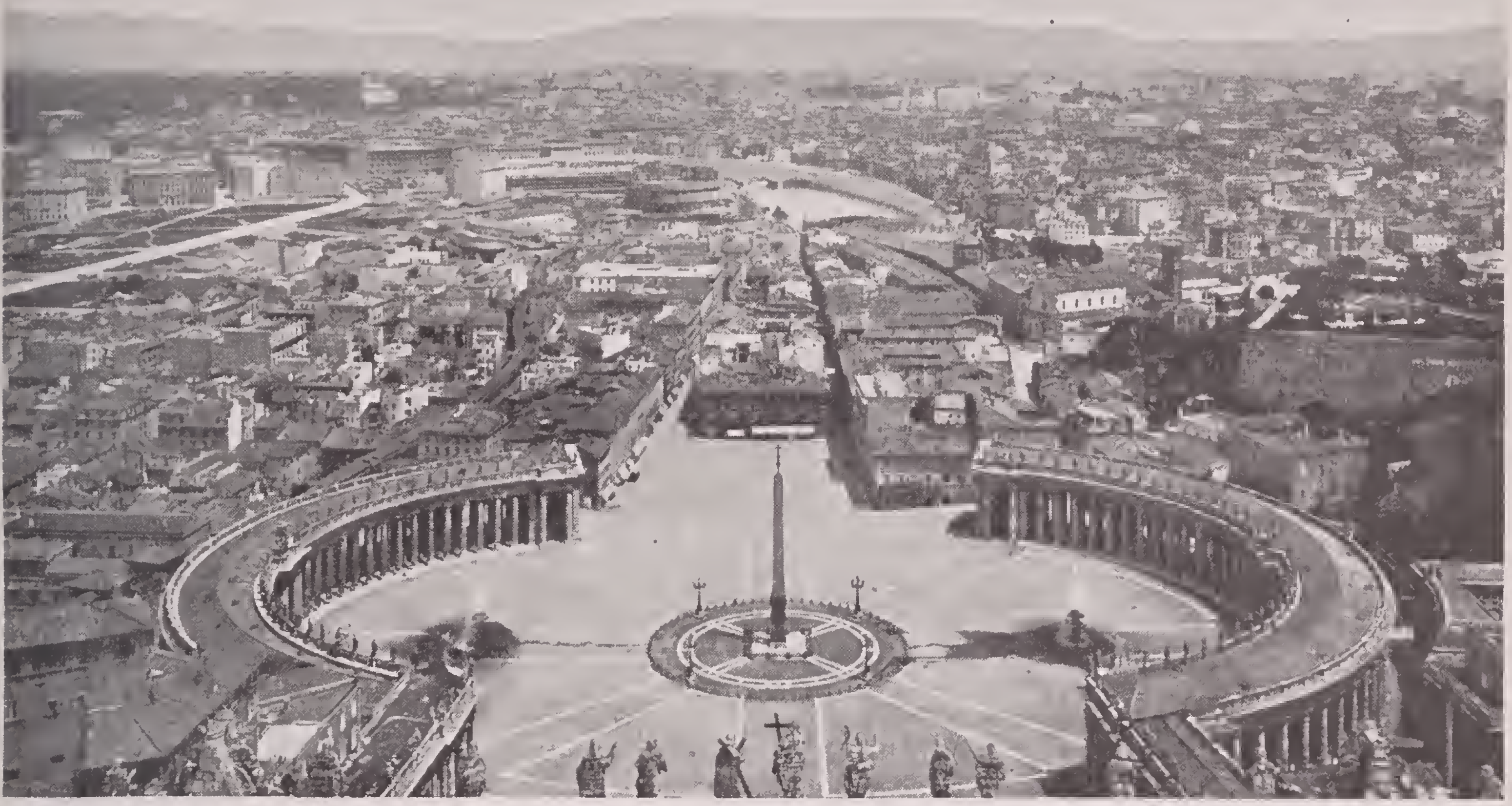
Here is a gallery of pictures which no money in the world could buy; here are miles of sculptures, which speak of the world that was for ages and ages before the United States began. Here is Augustus, the mail-clad ruler of the world, who "found Rome brick and left it marble"; he who ordered the census which took Mary to Bethlehem and made a manger sacred and immortal, as the birthplace of an empire compared with which the empire of Rome was like a home of ants! Here he stands, this splendid Caesar, seeming, as somebody said, as if he were speaking those words: "Din of arms shall cease, and days of hardship shall be softened." Here, too, Demosthenes, chiseled by a man who knew him, his face caught at the moment when he is trying to catch the ear of a frivolous crowd by warning them of a danger to Athens, and we seem to hear him crying, "Oh Athenians, my countrymen, when I talk to you of political dangers you will not listen, and yet you crowd about me to hear a silly story about an ass."

"FATHER TIBER" ON HIS WAY THROUGH ROME

"Father Tiber" was the name affectionately given by the ancient Romans to the stream which flows through their city. It is a swift-flowing stream, about 250 feet wide at this point, but it carries with it an enormous amount of alluvial matter, which gives the water the yellowish color for which it has always been known. At the right is the Castle Sant' Angelo, and in the distance the dome of St. Peter's looms high over the city.

THE ANCIENT AND THE MODERN CITY IN PANORAMA





Above is a model of the ancient city as it would appear if restored. In the foreground is the Colosseum, the playground of the Romans. In the view below you see another great circular space, but this is no playground. It is the vast Piazza San Pietro, where George Eliot felt that nothing small or mean could appear; fronting on it is St. Peter's, the greatest church in Christendom. From the dome of the church the modern Rome spreads out in a panorama which dwarfs even the splendor of the ancient city.

Here is the famous Laocoön, that terrible group of a father and his sons in the coils of a snake; one of the very greatest sculptures in the world, which stood in the palace of Titus, the conqueror of Jerusalem, who came back to Rome and set up a beautiful arch, on which is seen today a picture of the Temple swaying in its fall.

Here is the Sistine chapel, decorated with paintings by Michelangelo, most famous of which is 'The Last Judgment'. Two apartments are given over to the masterpieces of Raphael, including his celebrated 'School of Athens'. Besides innumerable great paintings on the walls of its rooms and chapels, the Vatican contains six museums—the Clementine museum of Greek and Roman art, with the celebrated Apollo Belvedere; the Chiaramonti museum of classical art; the Gallery of Inscriptions, where some of the most valuable records of early Rome are kept; the Etruscan museum, with relics of prehistoric Latin peoples; the Egyptian and the early Christian museums. In the Vatican library also are more than 40,000 manuscripts, making it the greatest single source of accurate historical knowledge in the world.

But it would need books and books and books to tell us of what is here; and so packed with wonderful things is Rome that a book could only begin to describe it. Through the heart of the town runs the famous Corso, the chief modern street of Rome. At one end of it is the convent where Luther stayed on that visit to Rome which opened his eyes and sent him out into the world to start the Reformation. Not far away sleeps the man who perhaps may have kept the Reformation out of Italy, Ignatius Loyola, who took a little band of men into a chapel here and swore them to be faithful, and founded the Order of Jesuits which has covered the earth. A little distance off sleeps Fra Angelico, whose pictures travelers love to see; and beneath the altar of that same church, with the lights that never go out shining in the dimness, is the figure of a lady in a tomb with a glass front and two burning lamps in it—Catharine of Siena, the revered mystical saint of the 14th century.

But it is thus everywhere in Rome—wonder and terror are in the air. Beneath one of the most imposing monuments lies a pope who was born so low that he had no name; under the very dome of St. Peter's lies a man who was once an English beggar-boy. And so on forever—for it is not possible even to mention here a thousand things that travelers go to Rome to see.

We wonder that the narrow unpaved streets made of lava-stone, at the confusion of men and horses and automobiles mixed up everywhere. We wonder at the sound of running water in the streets, especially at night, when the trickling of the fountains is weird and odd. We are puzzled by the hills of Rome, where at times the next street is up an elevator or through a long white tunnel or up a hundred steps—and perhaps Michelangelo made the steps. We wonder at the frescoes on the outside walls of houses, lit up sometimes at night with electric lamps; and if we are passing a great house in the dark we may be startled, perhaps, by the appearance of white figures seeming to step out into space from niches in the wall. We start back at the sight of living wolves close to us on the Forum steps. It is part of the weird mystery of the Eternal City, the spirit of the Colosseum, the memory of the Forum—the something that creeps out of Caligula's palace at night and fills the air with the terror of the Past.

Once you go to Rome there will come into your life something that will never leave it until life ends; and you will want to go to Rome again and again and again, to feel yourself a far-off looker-on, through the veil of centuries, at the greatest pageant Time has ever seen.

Aspects of the Modern City

And now let us take a somewhat closer view of the "City of Seven Hills." Without doubt it surpasses all other cities in the world in historic interest. Not only was it the capital of the great empire which first brought to a large part of Europe law and orderly government and the arts of civilized life; it remained the center of European life in the Middle Ages, and is today at once the capital of the government of modern Italy, and the seat of the papacy, the head of the great Roman Catholic church.

Historians are agreed that the greatness of Rome is entirely man-made. Its geographical situation is unfortunate. Lying on the narrow Tiber River, 17 miles from its mouth, it has none of the advantages of a seaport, and the comparatively barren plain surrounding the low hills of the city was until recently covered with unhealthful marshes, breeding pestilence and disease. Despite its great history and its modern political and religious importance, Rome is only third in size among Italian cities, being exceeded by both Naples and Milan.

Modern Rome has expanded somewhat beyond the original seven hills—the Capitoline, Palatine, Aventine, Quirinal, Viminal, Esquiline, and Caelian hills. It now spreads over nine or ten ridges, none of which was ever very high, and all of which have been cut down until now they are hardly distinguishable. Until 1871 Rome was ruled by the pope as its temporal prince, and there were few residences on these historic hills. They were covered with vineyards and ruins, and the city proper was crowded down along the left bank of the Tiber on what used to be known as the *Campus Martius* (Field of Mars). The Palatine and Capitoline hills, once the centers of living Rome, with the nearby Forum, are now the chief spots where one may study the ruins of the past. At the foot of the Capitoline a modern monument to Cola di Rienzi reminds us of the ill-fated attempt of this "last of the Tribunes" to restore, in the 14th century, the long-vanished forms of the Roman Republic.

A City of Palaces and Hovels

Despite its ancient ruins and artistic riches, Rome today still lacks the imposing aspect of many other European capitals. The streets in great part are narrow and irregular, and palaces and hovels often exist side by side. In recent years a gradual transformation has been taking place. Broader streets are being opened and tunnels have been dug under some of the hills which interfere with traffic.

The part of the city which lies on the right bank of the Tiber is more open and modern in appearance. Here are the Vatican and St. Peter's and the broad spaces of Monte Gianicolo, the ancient *Janiculum*. The walls of the city, which on the left bank date back to the third century, are about 14 miles around and are pierced by 19 gates. The most important of these is the Porta del Popolo, through which passed the ancient *Via Flaminia*, the Roman highway to northern Italy. The old Appian Way left the city by a southern gate. Remains of other great roads may still be seen, relics of that vast system stretching over a great part of Europe, when "all roads led to Rome."

Between these two parts of the city the Tiber has a winding course of three miles, confined between stone embankments built in modern times to guard against its fierce floods. A dozen bridges connect the two portions of the city. The chief street of Rome today is the Corso Umberto Primo, which leads from the center of the old city out through the Porta del Popolo; it is named in honor of King Humbert I (1878–1900), who succeeded his father Victor Emmanuel II, first king of modern Italy.

The throngs of modern Rome present a cosmopolitan aspect hardly exceeded by Paris. Tourists from all quarters of the globe, soldiers in gay uniforms, *carabinieri* or military police with plumed hats, black-robed priests, and sandaled monks in brown or gray or white mingle with the peasants from the hills; while among them honk and rattle the automobiles of the rich and a host of yellow motor busses. Viewing this throng, it is difficult to turn the imagination back to the days when solemn and magnificent processions of popes and cardinals moved through these streets, and to the remoter times when proconsuls and emperors led their conquering legions in triumph past acclaiming crowds of senators and people.

The Vatican hill is situated in the extreme northwestern corner of the city; and the papal residence, which was begun in the 13th century, while the popes still lived in the Lateran palace at the opposite end of Rome, was primarily designed as a sort of fortress in which the popes might be safe from attacks of foes inside and outside the city. The walls which almost completely surround it were built when the popes took up their permanent residence there in 1377. From behind these walls and with all approaches guarded by the Castle of Sant' Angelo—the massive tomb of the emperor Hadrian, long ago converted into a powerful fortress—the papal lords of Rome could easily dominate the city.

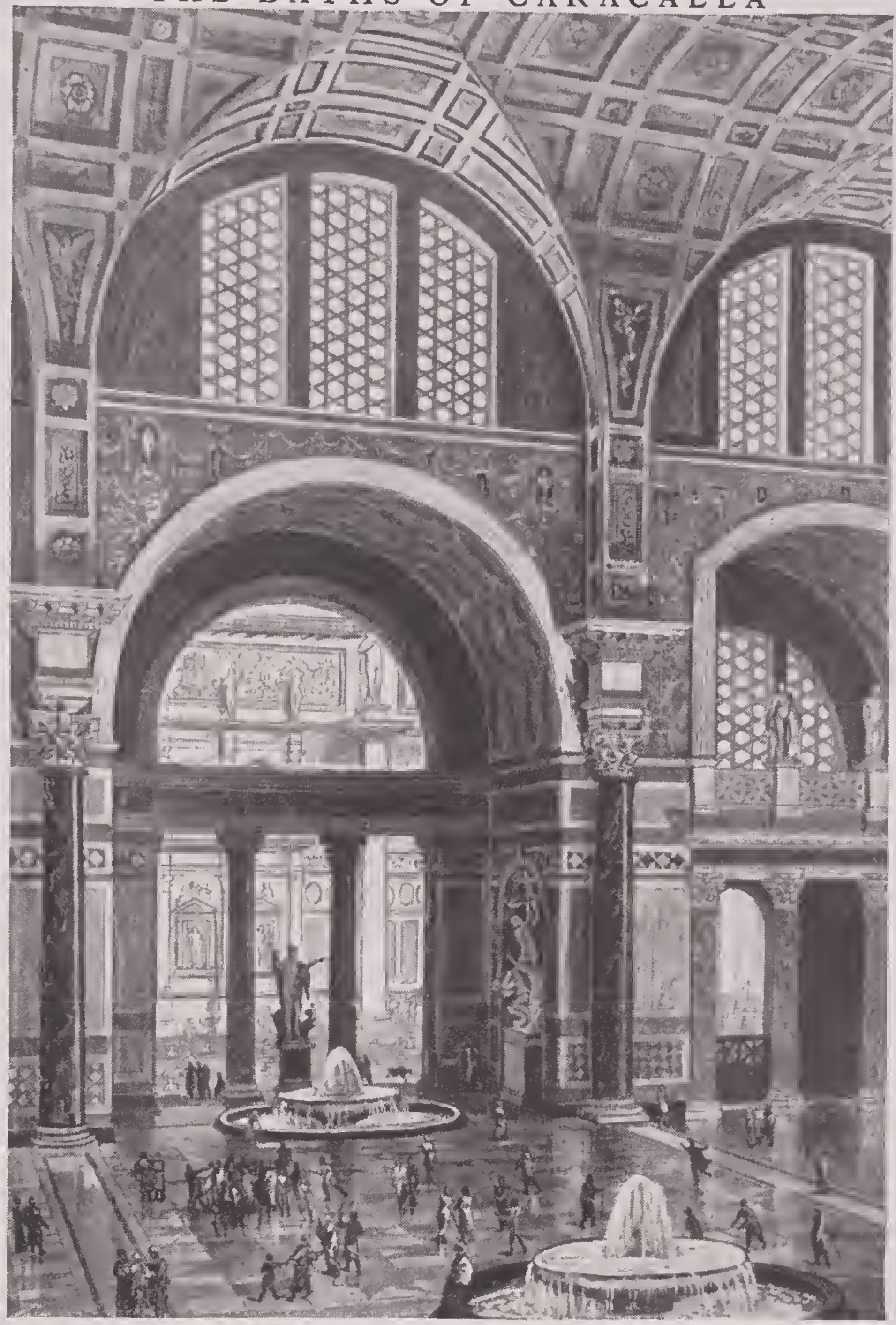
The palace of the Quirinal, which since 1871 has been the residence of the kings of Italy, is situated in the exact center of the old town, on the left bank of the Tiber. It has no great architectural merit, but it is the hub of a group of enlarged modern thoroughfares which radiate toward all points of the compass.

It is impossible to give a list of the many churches and palaces which possess historic and artistic interest. For centuries Roman pontiffs and cardinals and the Roman nobility vied with each other in erecting magnificent palaces and places of worship. Next to St. Peter's, the church of St. John Lateran is perhaps the most important. It is the mother church of Rome and was the scene of the five famous Lateran councils.

Among the palaces made famous by the names of the great nobles are those of the Borghese, the Farnese, the Rospigliosi, and the Colonna. These were built in the turbulent days when a man's home was literally his castle, and many a bloody fight was fought before these doors between defenders within and besiegers without.

Few buildings of the days of the republic or early days of Christianity remain standing in Rome today. In view of the violence suffered by the city during many centuries, it is surprising that a single stone is left in place. A dozen times enemy forces camped within the walls and gave the city over to pillage. On five of these occasions immense damage was done. The Gauls thoroughly plundered the city in 390 B.C. Alaric and his Visigoths sacked Rome just 800 years later, in 410 A.D. The Vandals followed close on the footsteps of the Goths in 455, and by their furious destruction created the new word "vandalism." In 1084 the Normans of southern Italy, who had been called in by the pope, seized the opportunity to plunder the city. And finally the soldiers of "his Catholic majesty" Charles V, Emperor and King of Spain, ravaged Rome terribly in 1527. Greater perhaps than the destruction by any one of these invasions was that wrought by Romans themselves, who for ages plundered the structures of ancient Rome to obtain materials for their own buildings.

THE BATHS OF CARACALLA



The Emperor Caracalla has little claim to fame except that he built the magnificent bath house, of which the picture is an idealized restoration. Bathing was a social institution in the later days of Rome, and the larger *thermae* or baths accommodated two or three thousand people. Within the great luxuriously adorned central hall, fashionable idlers gossiped away much of the day.

But despite the assaults of time and man, many remnants of Rome's ancient glory remain, for the Roman emperors built solidly and on a vast scale. For many years excavations have now been carried on and gradually the ground plan of the city of the Caesars has been brought to light. Perhaps the most famous series of ruins is to be found in the great Forum at the foot of the Palatine hill, including the remains of at least seven temples. The temple of Vesta, goddess of fire, with the home of the Vestal virgins near by, is the most noteworthy in this group. The best preserved of the ruins is the Pantheon, which has been a model for modern classic architecture the world over. It is now used as a church.

Everyone has seen pictures of the Colosseum, the great ruin which still stands in the midst of modern Rome. When it was dedicated as an amphitheater by the emperor Titus in the year 80 A.D., it was probably the richest and most imposing building in the world.

It is said that when the Romans began the habit of taking hot baths, the downfall of their empire set in. Their love for this form of luxury—for in those days of primitive plumbing it *was* a luxury—is shown by the many remains of *thermae* or bathing palaces scattered throughout the empire. The most noted of these in Rome are the baths erected by the mad emperor Caracalla, and those built by Diocletian, Nero, Titus, and Trojan.

In the Roman household plumbing was primitive. But the engineering feats by which they brought pure drinking water to the city were nothing short of marvelous (*see* Aqueduct).

Because of its many objects of historical and artistic interest, Rome today remains one of the great culture centers of the world. Of its many scientific and literary institutions, the university of Rome is the most important. The Catholic church maintains several large colleges for training priests and missionaries; and the United States, as well as some other countries, has here a school of classical studies. There are besides innumerable schools of art, architecture, and music, and Rome has one of the largest military hospitals in Europe.

The industries of present-day Rome are unimportant, being confined chiefly to the manufacture of silk fabrics, jewelry, glass, pottery, and kindred trades. The surrounding country produces cattle in moderate quantities. Population, about 591,000.

'ROMEO AND JULIET'. In this romantic Shakespearean tragedy, old Capulet, head of a noble house in Verona, Italy, invites his friends and kinsmen to a masque in honor of his beauteous only child, Juliet, whereat it is his hope she may be betrothed to the rich Count Paris. Young Romeo of the house of Montague, whose ancient feud with the Capulets has filled the city streets with many brawls and duels, dons a disguise in sport and mingles with the invited guests for a dance or so. No sooner does he set eyes on the exquisite beauty of Juliet than he has fallen irrevocably in love with her and she with him. They are secretly wedded by their father confessor, the Friar; but before the wedding day is spent Romeo is provoked into slaying a Capulet, and is straightway banished from Verona. Old Capulet now commands Juliet to prepare for immediate marriage with Count Paris. To save herself, she swallows a drug given her by the Friar, by whose action she is thrown into a deathlike trance until word can be sent to Romeo to come and bear her away with him. But Romeo hears that she is dead. He arrives frantic at Verona, breaks into the tomb where Juliet lies, and at the foot of her bier ends his life. Waking from her trance and discovering the sad miscarriage of her plan, Juliet makes Romeo's dagger the instrument of her own death and dies upon his body. Thus the children of the Capulet and the Montague become "poor sacrifices of their enmity," and by their deaths heal the ancient feud.

One of the most enchanting scenes in literature is found in this play—the famous balcony scene in the garden of the Capulets, where Juliet is wooed by Romeo, and in return discovers her love to him. The whole is in language of purest passion and poetry. Thus Romeo, observing Juliet at her window and seeing that her lips move, is stirred to ecstasy—

> I am too bold. 'Tis not to me she speaks:
> Two of the fairest stars in all the heaven,
> Having some business, do entreat her eyes
> To twinkle in their spheres till they return.

And Juliet, sighing to the night, astonishes and delights his ear with this—

> O Romeo, Romeo! Wherefore art thou Romeo? . .
> What's in a name? That which we call a rose
> By any other name would smell as sweet;
> So Romeo would, were he not Romeo called,
> Retain that dear affection which he owes
> Without that title. Romeo, doff thy name
> And for thy name, which is no part of thee,
> Take all myself.

ROMULUS AND REMUS. The Romans were very proud of their origin, for they believed that the father of Romulus, the mythical founder of Rome, was Mars, the god of war. His mother, the daughter of King Numitor of Alba Longa, was said to be descended from the great Trojan hero Aeneas, a son of the goddess Venus. According to the legend, a brother of King Numitor usurped the Alban throne and ordered Romulus and his twin brother Remus to be thrown into the river Tiber. They were miraculously saved, however, and were nursed and cared for by a she-wolf, until discovered by a shepherd who brought them up in his home.

When the brothers grew up, they decided to found a city on the banks of the Tiber; but in a quarrel which arose over the naming of the city Remus was slain. Romulus then built the city, which was called by his name, and invited all outcasts and fugitives, so that it grew very rapidly. After having firmly established his city and made peace with the neighboring people, Romulus was caught up to heaven, during a terrible storm, to dwell with his father Mars. Afterwards he was worshiped by the Romans as Quirinus.

The INSPIRING CAREER *of* AMERICA'S *Most* STRENUOUS PRESIDENT

ROOSEVELT, THEODORE (1858–1919). In the 1860's and 70's a boy was growing up in New York City who was to become later a Dakota ranchman, hunter of Western grizzlies and African lions, a South American explorer, a strenuous Republican advocate of reform, governor of New York state, vice-president, and finally the 26th President of the United States—the youngest man who ever attained that great office. In his boyhood Theodore Roosevelt was probably the last youngster in the country for whom such a career would have been predicted, for he was pale, thin, near-sighted, and asthmatic; he was the son of a wealthy New York merchant of unbroken Dutch descent from the days of Peter Stuyvesant, though his mother was a Georgian whose brother served in the Confederate army.

THEODORE ROOSEVELT

Rancher, hunter, explorer, author, soldier, statesman, 26th President of the United States, he accomplished in each of his chosen fields of activity as much as many distinguished men accomplish in only one.

But young Theodore was fond of books and natural history, and endowed with a remarkable memory and Dutch perseverance and concentration, in spite of his handicap of ill health. He was shielded from boyish rough-and-tumble, and educated chiefly at home up to the time he entered college. At 14 he resolved to build up his body. From that time forth, he led an active outdoor life, pursuing manly sports, not for the sake of excelling but for the physical benefit. In the course of years he thus attained the splendid physical constitution which was one of his assets in later life.

"I began my education early," he writes, "immediately after leaving college." This implies no disrespect for Harvard, from which he took his degree in 1880, and of which he was always a strenuous supporter; it merely emphasizes his conviction of the importance of *life* as an educational institution.

The comfortable family fortune of the Roosevelts enabled Theodore Jr., even though he married in the year of his graduation, to disregard the bread-and-butter problem in choosing a career. He was an active outdoor sportsman, now and again going west to hunt. He had begun writing a 'Naval History of the War of 1812' while in college, which was published in 1882. He joined the Republican organization of his district on graduation, and entered heartily into political party activities, all the more because they brought him into contact with saloonkeepers, street-car conductors, and other persons, with whom the son of a wealthy Knickerbocker family might be supposed to have little in common. These three strands of activity — outdoor sports, often combined with the study of nature, writing, and politics—run through his life to the end. He acquired a ranch in the Dakota Bad Lands, where he spent the two years following his young wife's death in 1884. He wrote steadily and voluminously—on history, politics, travel, and natural history—the number of his works totaling 30; indeed, he long regarded writing as his vocation and his political activity as the mere fulfilment of his duty as a citizen. In politics he was early a party man, though never in the sense satisfactory to the bosses of the machine; and a party man he remained except for one memorable episode.

Roosevelt was elected to the New York state legislature in 1881, being at 23 the youngest member of that body. Although he attacked corruption fearlessly, and as some thought quixotically, he was twice reëlected. The alarm of wealthy Republicans at Henry George's "single tax" teachings led them to make Roosevelt their candidate for mayor in 1886, when Henry George was running for the office; but both candidates were defeated by Abram S. Hewitt, the Tammany nominee. "Anyway," said Roosevelt, "I had a bully time."

The value of publicity to good government in a democracy is not a Roosevelt discovery, but no one ever used it more effectively. When President Harrison made him a member of the United States Civil Service Commission in 1889, "front-page publicity" and his whole-hearted energy enabled him to accomplish more against the spoils system than all that had gone before. As police commissioner of New York City, 1895–97, under the reform administration of Mayor Strong, he again used publicity in restoring discipline and respect for law to a demoralized and graft-ridden police force. The same was true of his administration as governor and as president—but that is running ahead of our story.

In 1897 Roosevelt accepted the position of assistant secretary of the navy under President McKinley and rendered excellent service. But when war came with Spain next year he promptly resigned in order to become lieutenant-colonel (later colonel) of the famous regiment of Rough Riders, whose charge up San Juan hill in the face of Spanish shrapnel brought "Teddy" (as he was now affectionately called) warm commendation, promotion, and national renown. Two weeks after the Rough Riders were mustered out of service Colonel Roosevelt was nominated for governor of New York. He was elected by a good majority, although the Republican party's hold on New York state that year was most precarious—a circumstance to which, indeed, he owed his nomination.

ROOSEVELT'S
ADMINISTRATIONS
1901–1909

Intervention in Anthracite Coal Strike (1902).
Alaskan Boundary Dispute arbitrated (1903).
Department of Commerce and Labor created (1903).
Railroad Rebates abolished (1903).
Treaty with Panama for building Canal (1904).
Louisiana Purchase Exposition (1904).
Beef Trust declared illegal (1905), and Standard Oil Company indicted.
Mediation by Roosevelt to end Russo-Japanese War (1905).
Intervention in Santo Domingo (1905).
San Francisco Earthquake, April (1906).
Hepburn Act regulating Railroad rates (1906).
Intervention in Cuba (1906–09).
Meat Inspection and Pure Food Acts (1906).
Oklahoma admitted as a State (1907).
Japan assents to "Open-Door" Policy in China (1908).
Conservation Conference of state governors (1908).

The outstanding achievement of his administration as governor was his forcing the passing of a bill taxing the franchises of public service corporations; it was also significant of much in his later policies. This was bitter medicine to the wealthy corporations, and, fearing a second term for the intractable governor, the politicians of his party determined to sidetrack him by nominating him as vice-president—an office in which he would be harmless and forgotten.

Much against his own inclination, Roosevelt accepted the nomination, running with President William McKinley against the Democratic nominees, William Jennings Bryan and Adlai E. Stevenson (*see* McKinley, William). Six months after the election the assassination of President McKinley by an anarchist, in September 1901, made Roosevelt president at the early age of 42. Although an "accidental" president in his first administration, Roosevelt, with Charles W. Fairbanks as his running mate, was overwhelmingly reëlected in 1904, over the Democratic candidates Alton B. Parker and Henry G. Davis.

An "Accidental" President who Made Good

With Roosevelt's administration began a period of history which owes its intense interest to the dominance of the most forceful character in American political history. "The strenuous life" prevailed wherever Roosevelt was. He was a sturdy but not hair-splitting moralist, and his contempt was about equal for the "crook" and the good but ineffectual "mollycoddle." "Social justice" was the prime article in his political creed—not the lifeless, blindfolded justice whose only care is to hold steady the scales of mere legality, but an eager open-eyed justice, turning the electric torch on the relations of giant corporations to the public, the wasting and looting of the national resources, and the inefficiency and dishonesty of many public servants.

Roosevelt's disregard for precedents was shown in one of his early acts as president—his intervention, altogether outside his official duties, to prevent the public calamity of a coal famine during the anthracite coal strike of 1902. It was again a novelty when he caused the attorney-general to prosecute numerous railroads and other corporations for violation of the interstate commerce and anti-trust laws. At his initiative, and often rather reluctantly, Congress passed the pure food law, the meat inspection law, and the Hepburn law conferring the power of railroad rate-making on the Interstate Commerce Commission, and established the Department of Commerce and Labor. The "malefactors of great wealth" who felt the rigors of the law denounced the president as a "revolutionist," "anarchist," and "socialist." The true socialists, who distrusted and deprecated reforms which would tend to make the present economic order more tolerable, knew better.

One of the best things which the Roosevelt administrations did for the country was to define the policy of conservation of national resources. In early days the supply of public land seemed inexhaustible; hence it passed rapidly and with reckless disregard of the future—and without adequate compensation to the public—into private hands. By 1909 four-fifths of the forests were privately owned. The unregulated and wasteful cutting of timber meant destruction of the lumber supplies at an early date, as well as injurious floods and denudation of the soil. Water-power and mineral resources were likewise being privately appropriated and squandered without regard to the rights of the public or the needs of the future. The appointment of a National Conservation Commission, the development of the usefulness and activity of the United States Forest Service, the calling of a conservation conference of state governors in 1908, the

ROOSEVELT TELLS KIPLING ALL ABOUT EVERYTHING

Theodore Roosevelt's most striking characteristic was his enthusiasm. He was as enthusiastic in praise of things and people he liked as he was in scorn or contempt of those he disliked. Even on matters which seemed remote and abstract to many people, he was always vigorous in the expression of his opinion. On a visit to Washington during Roosevelt's presidency, Rudyard Kipling used to meet the President at the Cosmos Club, where as Kipling says, he "sat curled up in a seat opposite him, and listened and wondered until the Universe seemed to be spinning around, and Theodore was the spinner." Our artist has depicted both men in a characteristic attitude. The President, with his left hand clenched, high in the air, and his right hand thrust forward in a quick gesture, is evidently driving home a point in his argument, not without a little fun, as the smile on his face indicates. Meanwhile Kipling, himself a man of strong enthusiasms, seems content to listen attentively, while Theodore spins the Universe around.

reservation for public use of millions of acres of public land, and above all the formulation of a definite policy of administration of the public lands in the interests of the public constitute the notable program of accomplishments of this administration in promoting the policy of conservation.

"Speak softly and carry a big stick," was the Roosevelt policy in foreign affairs, and in this department, until 1905, he had the invaluable assistance of John Hay, whom McKinley had appointed secretary of state. When Germany in 1903 refused to arbitrate certain financial claims on Venezuela, threatening to land troops to occupy Venezuelan territory until the debts were collected, she was informed that such action would constitute an infraction of the Monroe Doctrine and the American navy would forcibly prevent it. The kaiser consented to arbitrate. The president, however, issued warning that the Monroe Doctrine furnished no refuge for defaulting debtors. Santo Domingo in 1904 attempted to evade her obligations to other countries, so in 1905 the United States took charge of the Dominican customs and undertook adjustment of the claims.

The Building of the Panama Canal

Arrangements for the construction of the Panama Canal were blocked in 1903 by the vacillations and attempted extortions of the politicians who made up the government of Colombia. Making an agreement with them, Roosevelt exclaimed, was like "trying to nail currant jelly to the wall." The outcome was a revolt of the inhabitants of the isthmus, the formation of the Republic of Panama, which the United States promptly recognized and with which President Roosevelt negotiated the treaty under which the canal was constructed (*see* Panama, Republic of). Roosevelt's action in the Panama affair has received both censure and praise in plenty—censure because of the support given by the government of the United States to the Panama revolution, and praise because this unceremonious cutting of the Gordian knot was the most direct if not the only way to secure the building of the canal.

President Roosevelt's mediation and strong personal influence brought the Russo-Japanese War to an end in 1905; and for this service to the cause of international peace he received the Nobel Peace Prize. He labored in other ways for the advancement of international arbitration, but he believed that there was a limit to the causes which could be submitted to arbitration and wished the nations of the earth to know that this preference for peaceful methods arose from no lack of physical power in this country. One of the achievements of his administration which gave him greatest satisfaction was the demonstration of the naval power of the United States in 1908 by sending the fleet to Japan and around the world.

Roosevelt's reëlection in 1904 was on a party platform which contained the principle of national control of corporate business. He declined to consider a third term, in 1908, but his great popularity enabled him practically to nominate his successor, William H. Taft of Ohio, the secretary of war, as representative of the "Roosevelt policies."

A few weeks after Taft's inauguration the ex-president sailed for Africa, where he spent nearly a year in hunting big game. On his return home, after a semi-royal progress through Europe, he found a wide break between the "insurgents" and the administration Republicans (*see* Taft, William H.).

Leader of the Progressives

It was against Roosevelt's nature to refrain from defense of principles which, he felt, had been abandoned and betrayed by his successor. By 1912 his "hat was in the ring" as the recognized candidate of what was now known as the "Progressive" wing of the Republican party for the presidential nomination. A bitter contest developed between the administration forces and the Progressives for the control of the Republican National Convention, which met at Chicago in June of that year. The "steam roller" decisions of the national committee on contested seats gave the control of the convention to the administration Republicans or "standpatters," and ensured the renomination of President Taft. Roosevelt and the Progressives, charging that the nomination was "stolen," bolted the convention and met separately to organize a new Progressive Party, and in August, with almost religious fervor, Roosevelt was again nominated for the presidency, with Hiram Johnson as vice-presidential candidate, on a platform demanding popular election of United States senators, direct primaries, direct election of delegates to national conventions, the initiative, referendum, and recall in state constitutions, and a stricter law against corrupt practices in elections. Progressivism was at once a moral creed and a wave of romantic enthusiasm for an idolized leader. Roosevelt ran far ahead of Taft in the election, and the split in the Republican ranks insured the election of the Democratic candidate, Woodrow Wilson.

His Exploration of Unknown Brazil

In 1913 the ex-president found an outlet for his energies in an expedition to a practically unknown portion of Brazil, in South America; and in recognition of his achievements the Brazilian government gave the name "Rio Teodoro," in his honor, to a tributary of the Madeira whose course he first explored. Shortly after he returned to the United States, the great World War broke out, in 1914.

Roosevelt was thoroughly out of sympathy with President Wilson's policies toward that conflict. He believed that the invasion of Belgium made Germany an outcast among nations, and wanted the United States at once to enter the war. So in the presidential campaign of 1916 he vehemently supported Judge Charles E. Hughes, although Hughes' attitude on the war remained undefined. This return of Roosevelt to party regularity was virtually the end of the "Bull Moose" Progressive party which he had called into existence.

When the United States finally entered the war, in 1917, Roosevelt offered to raise and head a division of volunteers, and was greatly disappointed by President Wilson's refusal to accept his services. His four sons all entered the army, and Quentin, the youngest, was killed in service.

In his Brazilian expedition Roosevelt suffered great hardships, from which his constitution never recovered. During the following five years his health failed gradually; and on Jan. 5, 1919, he died quietly in his sleep at his residence on Oyster Bay, Long Island, N. Y. By his first wife he had one daughter, Alice; by his second, whom he married in 1886, he had the four sons mentioned above and a daughter. He received honorary degrees from Columbia University, University of Chicago, and other American universities, and from Cambridge, Oxford, and Berlin universities abroad; and he was at one time president of the American Historical Association.

Though some smiled at his "platitudes"—his "discovery of the Ten Commandments"—Roosevelt vitalized with the energy of intense conviction the slack beliefs of thousands of the men and women of his time. His most vital contributions to the thought of his time were conveyed not so much in his many books, of respectable but not commanding merit, as in the barbed phrases and epigrams which transfixed the public mind with an idea. But he was above all a doer of deeds and not a juggler with words. He was hated and loved, honored for his independence and advocacy of the rights of the people, and dreaded not only by those whose illegitimate privileges he lopped off, but by many who honestly believed his violence and disregard of precedent constituted a menace to the country's institutions. Author, soldier, naturalist, explorer, and social moralist, he is unique among American presidents and statesmen for the variety of his activities and interests. There have been other presidents who proved that poverty need be no bar to the highest honors in the gift of the republic; Theodore Roosevelt proved that inherited wealth need debar no man from being a great democrat.

Roosevelt's chief writings were: 'Life of Thomas Hart Benton' (1886); 'Life of Gouverneur Morris' (1887); 'Ranch Life and Hunting Trail' (1888); 'The Winning of the West' (1889–96); 'American Ideals and Other Essays' (1897); 'Life of Oliver Cromwell' (1900); 'African Game Trails' (1910); 'The New Nationalism' (1910); 'Theodore Roosevelt, an Autobiography' (1913); 'Life Histories of African Game Animals' (1914); 'Through the Brazilian Wilderness' (1914); 'Fear God, and Take Your Own Part' (1917).

ROOT. The two important functions of roots are to anchor and support the plant and to absorb water and minerals found in the soil. A plant possesses a "tap-root" system when it has one stout prominent root extending for some distance into the soil. The "fibrous" root system is very different, with slender roots, much branched, as in the bean, corn, etc. Thickened or fleshy roots developed in clusters, as in the dahlia, are called "fascicled" roots. Roots are classified as soil, air, or water roots according to the medium in which they grow.

Each root is generally capped by a blunt root-cap of firm cells, which protect the delicate growing tip. Behind this cap are usually many slender root-hairs, which are devoted to the absorption of liquid foods and are constantly dying off and being renewed. It is popularly believed that the roots "nourish" the plant with minerals drawn from the soil. This is a mistake. The water and dissolved minerals taken up with it by the roots are essential to the building of the plant cells, but by far the largest proportion of the plant's food is derived from the carbon dioxide absorbed by the leaves (*see* Leaves).

Roots absorb the moisture from the soil through the tiny membranes of the root-hairs by a process called "osmosis," which causes the thinner watery solutions of the earth to be drawn through the membrane by the attraction of the thicker sap solutions in the root cells. Air is also taken from the soil by the roots for their own "breathing."

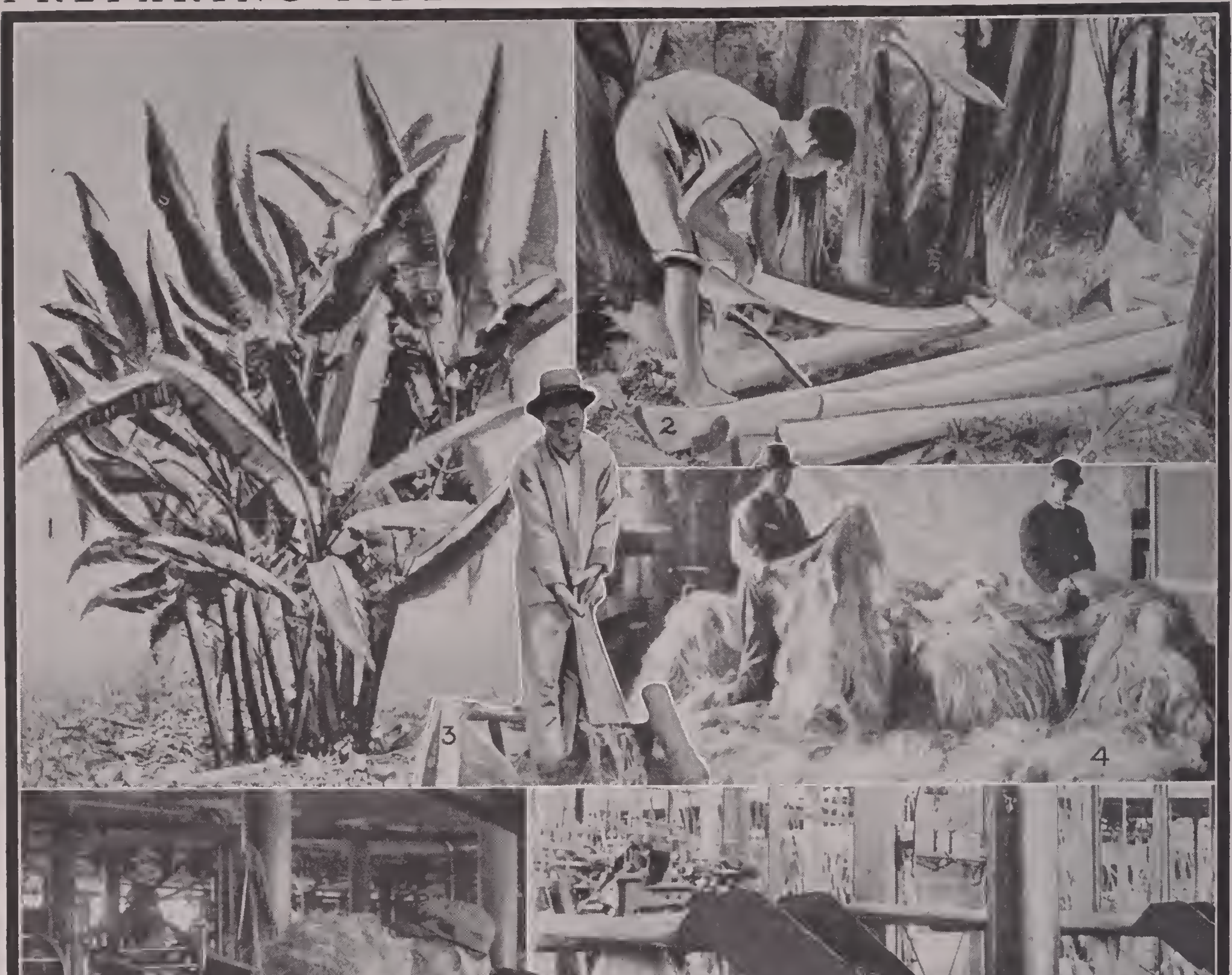
The force exerted by roots as a result of growth is remarkable. In rocky places it is a common thing to see small crevices in the rock where the slender roots of trees enter and split the rock apart as they enlarge (*see* Plant Life).

ROPE AND TWINE. The mention of rope suggests salt water, tarred rigging, ships being anchored or towed or docked, wharves, and big loads being hoisted. It makes us think of the din of the building industry, Alpine climbing, the cowboy swinging his lariat, or even a tug-o'-war. Rope is one of the most common and useful articles in man's existence; but the story of its development into the giant 23-inch cables and hawsers of today, capable of lifting a locomotive or a torpedo boat, goes out of sight into the far past.

Man's earliest cords or lines for fishing, tying animals, etc., were mere fibrous roots, strips of bark, or hide thongs, such as certain savage tribes still use. Ancient Egyptian inscriptions are believed to portray a form of rope-making. Prior to 1820, rope was made entirely by hand. The picturesque 'rope-walks' or old time hand process factories, established in Boston as early as 1642, were among the earliest industrial establishments in the United States. Then came machines for twisting hand-spun yarns into rope strands, and later yarn-spinning mechanism was developed. Near the middle of the 19th century steam-driven machines were introduced for making not only all cordage an inch or more in circumference —which goes by the general name of rope—but also all smaller cordage, called string, cord, or twine.

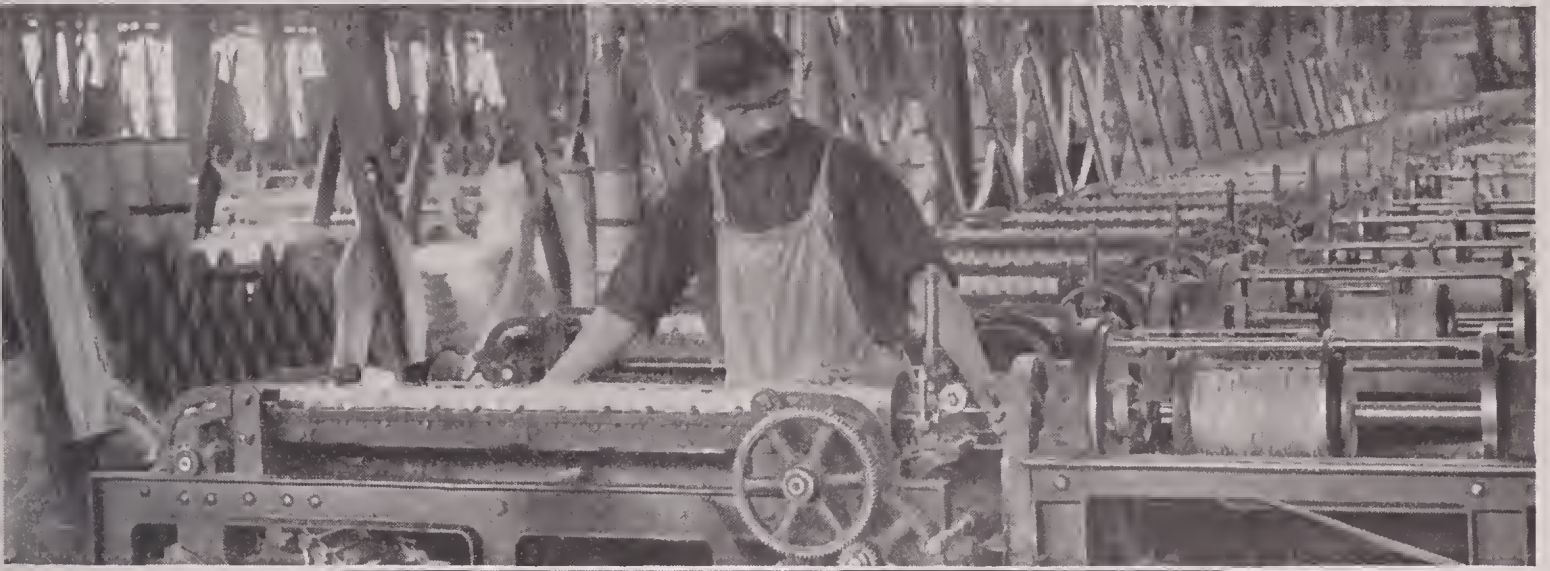
Cordage is made of various kinds of hemp, or fibers known under the name of hemp, especially manila fiber and its cheaper rival, sisal fiber, now much used in manufacturing binding twine for self-binding grain reapers, etc. (*see* Hemp). Other materials used are flax, cotton, East Indian jute, and coir, the fibrous casing or bark of the coconut.

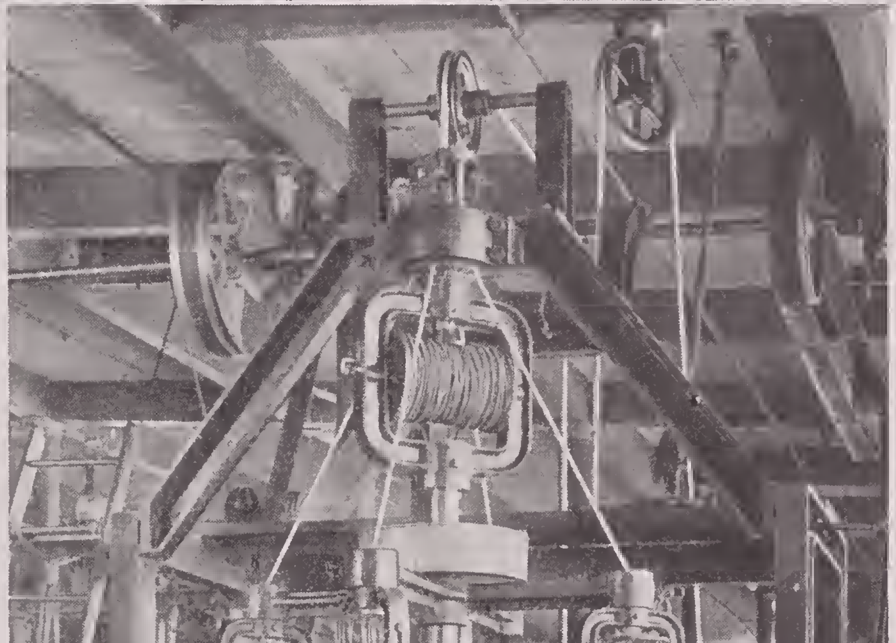
PREPARING FIBER FOR SPINNING INTO TWINE



When you walk away from a store with a little ball of manila twine in your hand, you little realize that you are giving that twine its last lift on a journey that has covered thousands of miles, over land and sea. Before any man touched it, it was a part of the manila plant (1), which is a native of the Philippine Islands. Until recent years practically all twine was made of manila, but now Mexican sisal, being cheaper, is also used widely. The manila plant is cut down by a brown-skinned little Filipino, who uses only primitive tools, perhaps a hatchet, but sometimes only a sharp stone or a forked stick (2). Another Filipino breaks the stalk into layers or strips (3), after which it journeys to some warehouse where it is carefully examined and sorted (4) before being shipped to America for manufacture into twine. Arrived at the factory, the fiber is first softened and combed (5) into long ribbons called "slivers." These usually go through a second combing or drawing (6), and sometimes more, depending on the grade of fiber and the desired quality of the finished twine.

SPINNING THE PREPARED FIBER INTO TWINE





When the manila fibers have been properly drawn and combed they next journey to the spinning room (upper picture), where they are first twisted right-handed into yarns, wound on large bobbins. The lower photograph shows the last processes of laying and forming the strand. At the top is one of the large bobbins, below that the revolving flyers which spin the strands together into twine and finally at the bottom, the many spools of finished twine.

The raw material arrives at the rope-making plant in great bales. It is loosened, spread in layers, sprinkled with oil, and then "heckled" or mechanically combed to clean and straighten the fibers. The fibers are twined and twisted end to end into one continuous *sliver* on machines called "breakers." Later the slivers go to the spinning machines. These twist the fiber right-handed into yarns, which are mechanically wound onto huge bobbins.

From the bobbins the yarns are fed to the strand-forming machine through holes in an iron face plate, so placed that the yarns all converge into a tube, where they are compressed into a bundle and twisted into strands by the revolution of a long carriage or flyer. In the "laying" machine the strands again pass through openings and converge in a central tube, through which they pass to a second set of revolving flyers; and these twist the strands together into rope. (In the most complete rope-making instrument the strand-forming machine and the laying machine are combined.) Thus rope-making is a series of twisting processes; and each twist is in a direction opposite to that of the preceding twist, so as to make the finished product tight and hard. Ropes are twisted together to form a larger rope, hawser, cable, etc.

The cordage is still frequently covered with pine tar or other tar (by means of copper troughs and pressing rollers) to protect it from the effects of moisture. But hemp ropes have been largely superseded in many industries by powerful wire cables, made of copper, iron, or steel wires twisted together in much the same way that hemp ropes are made.

ROSE. Since the days when the "sweet singer of Israel" sang the praises of the Rose of Sharon, civilized man has extolled the well-loved rose as he has no other flower. In ancient days many peoples could claim, as could the Greeks and Romans, that "in their joys and sorrows the rose was their favorite flower." The Romans in particular used incredible quantities of them, stuffing couches as well as covering them with rose petals, scattering them in palace halls, and on festive occasions, even in the streets. Nero outdid Queen Cleopatra's record of spending $2,000 on roses for just one day, for at a single feast it is said he expended $150,000 in roses! And once, it is said, his rose showers were so abundant that some unlucky guests were literally smothered in roses. In Persia and in all other places where the rose found its way love and honor awaited it. "The savor of the rose" sang Chaucer, smote to the "heart's root." And throughout the Middle Ages ran a thread of rose-romance; for this was the flower of chivalry—of love—as well as the badge of the two great English families whose feudal combats, rending England with civil wars, were known as the Wars of the Roses.

How readily has this "Queen of Flowers" responded to man's eager meddling! With what magic has the single five-petaled rose of the cottage garden—one much like our wild rose—changed its stamens into petals of various sizes and of every possible tint of pink and yellow and red! Because of its fragrance and its beauty, and because it is capable of producing more varieties than any other known flower, the rose has won a world triumph for itself and for devoted horticulturalists of Asia, Europe, and North America who have given up a lifetime in perfecting it.

The rose-grower may have another reward beside the happiness that comes to the lover of flowers; for the rose has a commercial value that no other flower possesses. The rose is of value horticulturally (as yearly in the United States alone 100,000,000 rose blossoms are sold at a value of about $6,000,000) and as the source of rose water and valuable attar of roses. This attar, an expensive oil of great fragrance, is distilled from the rose. It requires 40,000 flowers to make a single ounce of it. In the south of France roses are grown for this purpose, as they are in thousands of acres in Bulgaria where the finest grade of rose attar is obtained.

Roses are of the genus *Rosa* of the family *Rosaceae*. In the rose family are the apple, pear, plum, peach, blackberry, raspberry, and strawberry, and included as well are such ornamental plants as the mountain ash and spirea. In temperate and cold parts of the Northern Hemisphere roses are widely distributed. They are erect, climbing, or trailing shrubs, are generally prickly stemmed, with flowers borne either singly or in terminal clusters, which are followed by a berry-like fruit, generally red or orange yellow.

Botanists agree that there are thousands of varieties. These are sometimes divided into two large classes—*summer roses*, those blooming but once a year, and *autumnal roses*, those blooming more than once, some continuously from early summer until late fall. Among 19 important groups of these varieties are the moss rose, hardy garden, ramblers, teas, hybrid-teas, and hybrid perpetuals.

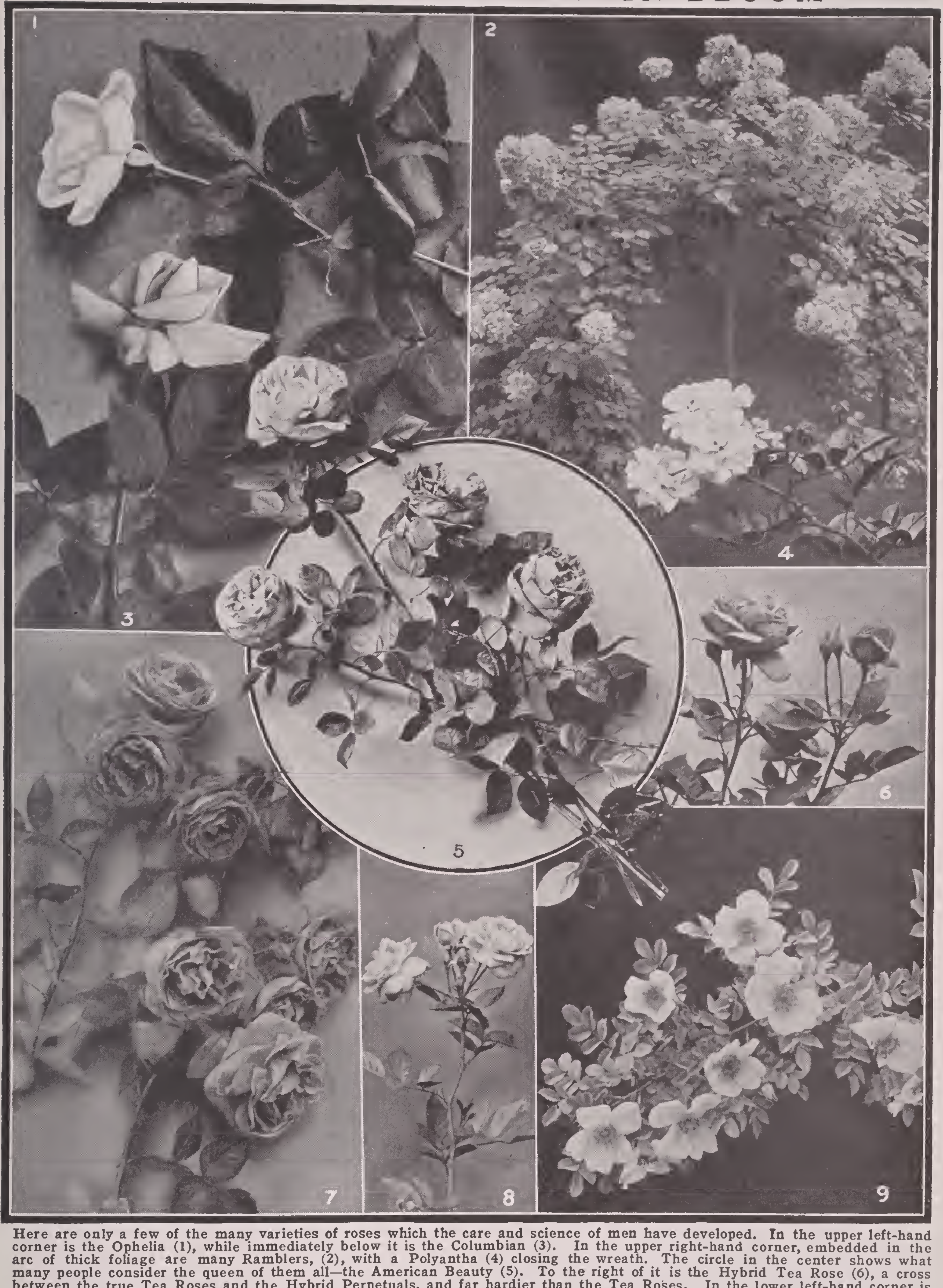
There are from 40 to 50 species of wild roses, ranging in color from white to pink or red. They all have single blossoms with five petals, and numerous stamens and pistils. In the many petaled cultivated varieties these stamens are transformed into petals. The swamp rose (*Rosa carolina*), found in damp thickets from Canada to the Gulf of Mexico, is one of the best known American species. The sweetbrier or eglantine (*Rosa rubiginosa*) is an Old World species naturalized in the United States. The Alpine rose of Switzerland and the Pyrenees is a climbing species with pink or red flowers.

ROSES, WARS OF THE. "The king's false council hath lost his law; his merchandise is lost; France is lost; the king himself is so set that he may not pay for his meat or drink, and he oweth more than ever any king of England owed." This contemporary indictment of the weak and ineffectual rule of Henry VI of England gives us in a nutshell one reason for the series of conflicts that raged in England in the middle of the 15th century. But in large measure the struggle was a selfish contest for political power between the great nobles, and did not greatly affect the common people. The name "Wars of the Roses" was given it because the House of Lancaster, which claimed the throne from the House of York, used the red rose as their emblem, while the badge of the House of York was the white rose. In general the country districts were Lancastrian and the cities Yorkist.

To understand the contest between these two houses you will need to look at the table on page 3068, and see just how each family was descended from King Edward III. Henry VI, the head of the Lancastrian house, represented the third line of descent from Edward III, while Richard of York was descended through his mother from Edward's second son and through his father from the fourth son. By strict rules of inheritance the Yorkists had a better claim to the throne than had the Lancastrians; but they had been passed over in 1399 when Richard II was deposed, and would have won no attention to their claims later if it had not been for the failure of the English armies in the Hundred Years' War (*see* Hundred Years' War) and for the misrule at home.

At first Richard of York planned merely to take the government from incapable persons and secure it for himself, but later his object was to seize the crown. His ablest supporter was the Earl of Warwick, who played so important a part, first on one side and then on the other, that he was called "the King-Maker." On the Lancastrian side the real head of the party was Queen Margaret, a young and beautiful French woman, who fiercely resisted the attempts to dethrone her husband, Henry VI, and disinherit her son, Prince Edward.

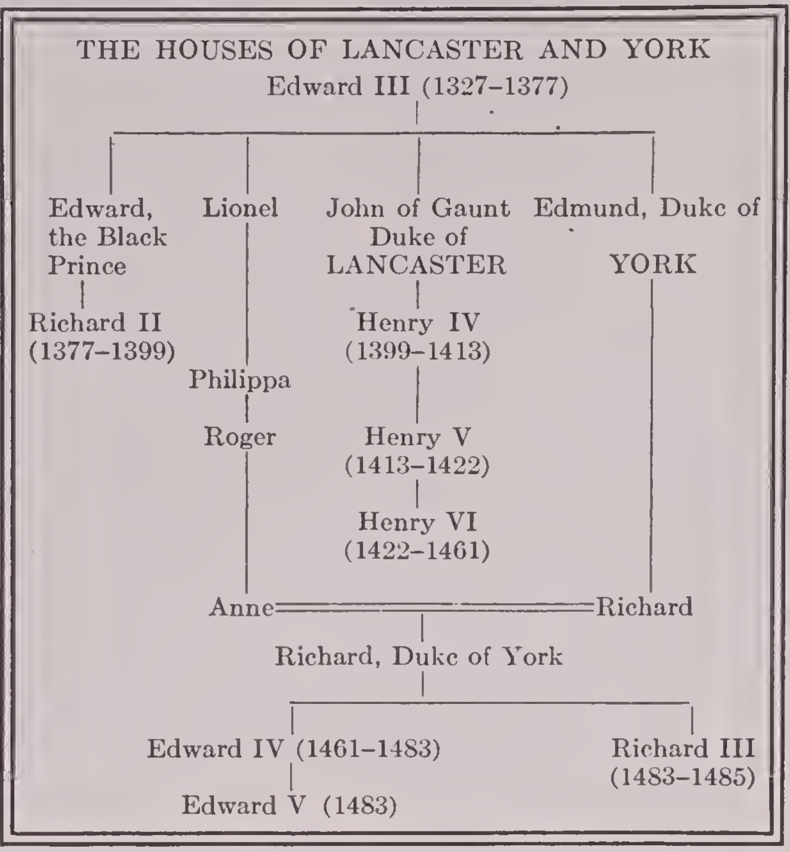
QUEENS OF ROSELAND IN BLOOM



Here are only a few of the many varieties of roses which the care and science of men have developed. In the upper left-hand corner is the Ophelia (1), while immediately below it is the Columbian (3). In the upper right-hand corner, embedded in the arc of thick foliage are many Ramblers, (2), with a Polyantha (4) closing the wreath. The circle in the center shows what many people consider the queen of them all—the American Beauty (5). To the right of it is the Hybrid Tea Rose (6), a cross between the true Tea Roses and the Hybrid Perpetuals, and far hardier than the Tea Roses. In the lower left-hand corner is the yellow "Marshal Niel" (7) and next to it the China Rose (8). The lower right-hand corner shows the common Prairie Rose (9).

The struggle was one of the cruelest and bloodiest in English history. It began with the battle of St. Albans, in 1455, in which York was victorious and secured control of the government. Four years later the contest was renewed, and after varying fortunes York was defeated and slain in battle by the forces of Queen Margaret at Wakefield (1460). But his strong and able son Edward IV obtained the throne, by Warwick's help, while poor insane Henry VI was shut up a prisoner in London Tower. Then Warwick quarreled with Edward, and aided Queen Margaret to drive Edward IV from England and restore Henry VI (1470). But next year Edward returned, Warwick was defeated and slain in battle, the young Lancastrian prince was captured and murdered at Tewkesbury (1471), and Henry VI died in the Tower by an assassin's hand the day Edward IV reëntered London. This ended the direct struggle, but a collateral one followed 12 years later in which Henry Tudor, the last Lancastrian representative, defeated and slew the last Yorkist king, Richard III, and won the throne for himself. This ended the Wars of the Roses, and as Henry married Elizabeth of York, daughter of Edward IV, the white and the red rose were united in the rose of the Tudors, the emblem of a new line of English kings. (*See also* Henry, Kings of England; Richard, Kings of England.)

THE HOUSES OF LANCASTER AND YORK



ROTTERDAM, HOLLAND. Have you ever wondered how Rotterdam came to have such a name? It's just the Dutch way of saying the "dam or dike of the Rotte River." The Rotte is a little river which runs into the Maas or Meuse, on the shores of which the city is built, and the dike from which the city is named stands where the two rivers meet.

Rotterdam is the second largest city in the Netherlands, and the most important commercial port. Although it is about 15 miles from the sea, the river is so deep and the tide in it runs so high that the largest vessels can come to dock there. Hundreds of acres of docks and basins have been built to take care of these ships that give the city its prosperity. For Rotterdam's chief business is trading by sea, in coffee, tea, tobacco, flour, sugar, spices, coal, oil, and all sorts of foodstuffs. The boats that sail from here go to all parts of the world, especially to the Dutch East Indies, and they bring back many valuable things. Rotterdam is also the center for the Rhine-Meuse water-borne traffic inland. Many of the ships are built in the Rotterdam shipyards, which form the city's leading industry. Sugar refining and the manufacture of cigars, margarine, paints, rope, and leather are also important items in the city's industries.

The ground on which the city is built is so low and spongy that most of the quaint old-fashioned wooden houses with their many gables are built on piles. A labyrinth of tree-bordered canals and waterways runs through the city in all directions. The principal quay is called the Boompjes, or "little trees." One of the town's most cherished treasures is a statue of the great scholar Erasmus, who was born here in the 15th century.

Rotterdam probably owes its existence to two castles which existed there in feudal times. Of late years it has grown very fast and has now about 507,000 people.

ROUND TABLE. When King Arthur of Britain gathered about him his chosen knights, according to the legends, they were seated at the famous Round Table, so that there might be no quarrels as to precedence and that the king might sit among them a man among equals. The name came to be applied to the knights themselves, as the title of the mythical order of chivalry—

> . . . that fair Order of the Table Round,
> A glorious company, the flower of men,
> To serve as models for the mighty world
> And be the fair beginning of a time.

According to the Arthurian romances, the table was made by the wise magician Merlin, and it came into Arthur's possession with the dowry of his queen, Guinevere. The legends differ as to the number of knights, some placing the figure as low as 50 or 150, and others making the number that the table would seat even larger.

Only the best and most valiant knights were adjudged worthy of a seat at the Round Table, and each chosen knight had his own seat with his name carved upon it. The members formed a brotherhood bound by oath to help one another in danger and to refrain from fighting among themselves. In the goodly company were brave Sir Perceval de Galis, one of the men that most believed in Christ; Sir Lancelot, beloved by the fair Elaine of Astolat; and Sirs Bors de Ganis, his cousin; Sir Gawaine, Sir Gareth of Orkney, and Sir Gaheris, all brothers, and nephews of King Arthur; Sir Tristram de Liones, the best huntsman of the world and the noblest blower of an horn; Sir Kay, the seneschal of King Arthur's court; Sir Ector de Maris, who was cured of his wounds by the Holy Grail; the traitor Sir Modred, who usurped the throne and tried to wed Queen Guinevere, but was killed in combat with King Arthur; the noble Sir Bedivere, who received the last commands of the king and became a hermit on the death of his chief; Sir Lamorak de Galis, Sir Sagramore le Desirous, Sir Palamides the Saracen, Sir Bleoberis, and many other brave and noble knights.

There was one seat, however, known as "the Seat Perilous," which had no name upon it. It was reserved for him who should succeed in the search for the Holy Grail—that mystic cup from which Christ had drunk at the Last Supper. It was filled at last by Sir Galahad, the perfect knight.

Tennyson tells many of the stories of the Round Table in his 'Idylls of the King'. (*See* Arthur, King; Galahad; Grail, the Holy.)

Romantic Legends of King Arthur's Knights

KING ARTHUR'S herald ran from the assembly hall to the marble steps that led to the palace gardens. There he blew a fanfare on his silver bugle to call the lords and ladies of the court.

"Prepare for the tournament!" he announced. "The knights of King Arthur's court will engage in friendly contests with all who come to the jousts. The last and largest of the nine diamonds goes to the victor."

Mounting his horse he galloped away to spread the news throughout the realm. By inviting untried youths of noble birth to enter the lists, in the annual tournament held at Camelot, King Arthur won recruits to his order of knighthood.

The knights yawned, and strolled away to idle game with the ladies. "What is the use of that contest of arms?" they said. "For eight years Sir Lancelot has been the victor, and won the prize. He will win the ninth diamond."

Now Sir Lancelot, sitting in her bower with Queen Guinevere, overhead this and reported it to the king.

"Sire," he said, "because I have held the championship for eight years, your other knights come to the jousts half-heartedly. Expecting to fail they do not fight their best. Therefore I will not enter the lists this year, but feigning weariness of spirit will ride away."

King Arthur agreed to this, but Queen Guinevere held private speech with him.

"Sir Lancelot, so long as you are undefeated you will remain the champion. So ride away, but return well disguised. Unnoticed among the many newcomers, you can enter the lists as the Stranger Knight. Put it to the test if your prowess be as high as your fame."

So Sir Lancelot rode away. He borrowed the horse and fittings of a simple country knight, and his son for a squire. Leaving his own well-known shield of the golden lions in the keeping of Elaine, "the lily maid of Astolat," he pulled the visor of his helmet down and rode to the tournament.

In a raised pavilion above the field, King Arthur sat with Queen Guinevere and the ladies, with the hundred and fifty armored and mounted knights of his court ranged below. At the other end of the field were ranged noble youths from every part of the realm, among them the Stranger Knight. When the trumpet sounded all put spurs to their steeds, poised their lances and galloped forward, each party to unhorse as many of the other as possible, without doing serious injury. The animals reared, spears rang on steel, swords crossed and shields clashed together, so close was the combat.

Many a proud knight was unhorsed and borne from the field. As the ranks thinned, it was seen that the powerful Stranger Knight was charging here and there, easily overcoming all with whom he contested. One after another he tumbled even champions of the Round Table from their saddles, and sent them rolling in the dust.

Alarmed and angry they withdrew. "Oh that Lancelot were here!" they cried. "This impudent fellow will disgrace us all." At that, forgetting the knightly code of honor, they all bore down upon the Stranger Knight. His horse reeled from the shock. His shield was struck aside. A spearpoint pierced his breastplate. The Stranger Knight lay bleeding on the field when King Arthur rose and cried:

"Foul play! It is an unknightly deed for so many at once to set upon a brave man."

They fell back in shame. But the Stranger Knight staggered to his feet. "Let me at them!" he shouted. "Since they fight that way, I will down them all at once."

Sore wounded and afoot, as he was, his sword flashed to right and left, slashing at steeds and riders until he unhorsed or sent all his assailants flying from the field.

With a fanfare of his silver trumpet, the herald proclaimed the Stranger Knight victor, and bade him come forward and receive the ninth diamond from the king.

"Give me air! I have no need of diamonds, since I have my death wound. Let me go hence to die in peace and follow me not."

While King Arthur and his court sat in sorrowful silence, the Stranger Knight rode away. His squire bore Sir Lancelot to a hermit's cell, and pulled the spear point from his side. Then the Lady Elaine brought him his own shield, and the victor diamond, and nursed him back to health.

When Sir Lancelot rode again to Camelot he was welcomed with rejoicing. His prowess was proved to be as high as his fame and he appeared in the lists no more. And having no lady of his own to adorn, he had the nine great diamonds set in a diadem for the fair Queen Guinevere.

The Kitchen Boy Who Became a Knight

GARETH, having learned gentle manners and all the feats of arms, wished to go to King Arthur's court and be a knight. But his mother, Queen Bellicent, was a widow. Her two older sons were Knights of the Round Table, and Gareth was all she had left in the world. So she wept, and begged him to stay with her. Seeing that he was determined to go, she thought of a clever plan to keep him.

"Very well, my son; but you must go afoot, and in mean disguise. You must tell no one who you are, and you must work for a year as a kitchen boy."

She thought Gareth would be too proud to do that. But knowing that he could still be a true knight in his heart, the noble youth put on the coarse clothes of a plowboy, and walked through the green land to the royal city of "many-towered Camelot." He had been in the palace kitchen no more than a month when his mother relented, and sent his sword and suit of armor, with a letter, to King Arthur. The King made Gareth a knight in secret, and promised that he should prove his worth by righting the first wrong.

That same day the fair Lady Lynette came to Arthur's court asking the aid of a knight. Her sister was a prisoner in Castle Perilous, guarded by four wicked nobles. Only the greatest of knights could hope to rescue her. Expecting Sir Lancelot, or other champion of renown, she was angry when only a kitchen boy was sent to her.

"Ride behind, as a servant should," she said, and she turned up a disdainful little nose. "You smell of kitchen grease."

Gareth was cruelly hurt by her scorn, but he did not forget the manners of a true knight. "Fair lady," he said, "I would rather fight four monsters at once than hear such unkind words from you," and took the place she indicated for the journey.

Well, of course he slew all those wicked nobles, and led the Lady Lynette into Castle Perilous, to a happy meeting with her sister. The maiden was ashamed of her behavior, and called the kitchen boy her true knight. She had spread a feast for him and was serving him in sweet humility, when the great Sir Lancelot came from King Arthur. He led Gareth's horse, and brought all his knightly fittings. So Sir Gareth married the Lady Lynette, and for a wedding journey they rode back through the green land to Camelot.

ROUSSEAU (*rṳ-sō'*), JEAN-JACQUES (1712–1778). This famous Swiss-French philosopher gave better advice and followed it less than any great man who easily comes to mind. He was born at Geneva, and in 1741 came down from the Alps to Paris, a little fat vagabond traveling secretary. "He imported with him the jealous individualism of Geneva, an almost German sense of simplicity and tender homeliness, and the Italian's worship of the beautiful"; and he imported all this into a French society which was organized to the point of artificiality, reasoning and regular, going like clockwork, sure of itself and warmly opposed to anyone who attempted to live contrary to its rules, or to think something new which its systems had not provided for.

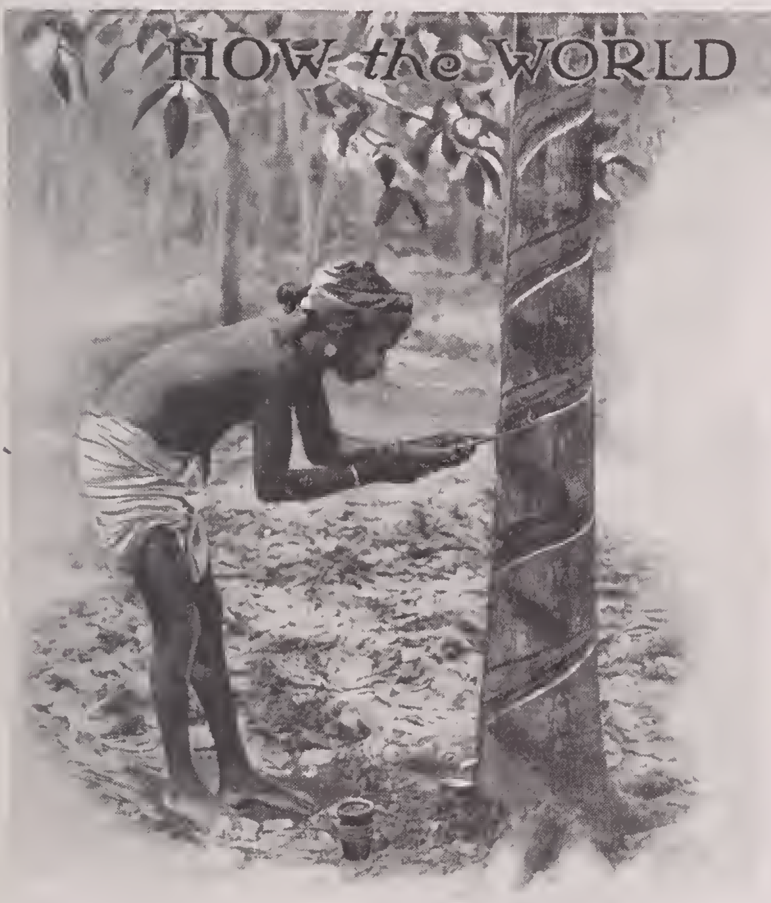
Yet this curious, stammering, emotional little Swiss upset that whole elaborate society. From the backstairs he had seen much of its evils and could not be flattered by it. He wrote his great book on the origins of government, entitled 'The Social Contract', teaching that no laws are binding unless agreed upon by the people; and this so deeply moved the French that he changed their political opinions entirely. In fact, from him more than from any other one man came the force that caused the French Revolution; and his expression, "Liberty, Equality, and Fraternity," became the war cry of those days of exaltation and horror.

Another of Rousseau's books, 'Émile', a novel, converted people to a new, simpler, saner method of education; and an earlier novel, 'The New Héloïse', restored the love of nature and of simple living.

Yet the man who preached social equality and personal freedom lived always oppressed by poverty and trying circumstances; the man who showed how to bring up a son, and wrote of the beauties of domestic life, abandoned his own babies and lived with his cook; the man who exulted in the beauties of nature spent most of his days on a city pavement; the man who taught modern hygiene dwelt in a stuffy garret. Rousseau was indeed a strange vessel for the wisdom he contained! He was denounced by the bishop of Paris for his religious views, fled the country, and lived for a time with the historian Hume in England. He later returned to France, broken in health and spirits. He died near Paris, a prey to unhappy delusions.

Rousseau's chief works are: 'La Novelle Héloïse' (The New Héloïse), 1760: 'Le Contrat Social' (The Social Contract), 1762; 'Émile' (1762); 'Confessions' (written 1761–1771, first published 1781).

HOW *the* WORLD GETS *Its* RUBBER



There are several ways of tapping rubber trees, of which one, the spiral method, is here shown. Notice how the thick creamy sap follows the knife.

RUBBER. The shock-absorber of civilization, and the tireless guardian of that magical force electricity, which does so much of our work! There you have in a nutshell two of the many indispensable services rubber performs for us.

This wonderful substance that oozes from certain kinds of trees has many amazing qualities. It is far more elastic than any other known substance. It may be made soft as a sponge or hard as ivory. It is a non-conductor of electricity, and at the same time is less affected by temperature, moisture, and chemical action than almost any other plastic substance.

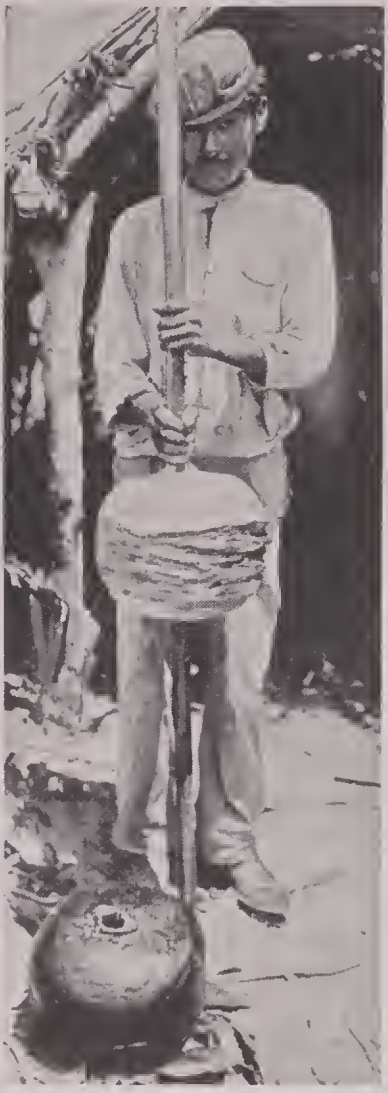
Because of these qualities, rubber is used for an almost endless variety of purposes. The belting and packing of machinery is often of rubber. In modern surgery rubber gloves are usually worn by the surgeons, and in the form of hot-water bottles and ice-bags, it is found in every sick room. Many tons of crude rubber are used annually to make rings for the sealing of fruit jars, and to make erasers for our lead pencils. Hundreds of miles of garden hose are manufactured every year. We walk on rubber heels, and when it rains we put on our waterproof coats and "rubbers" made of rubberized materials. In the field of sport rubber enters largely into the manufacture of tennis balls, baseballs, and many other articles. Perhaps automobile tires present the greatest single use of rubber. From hard rubber, which contains a greater proportion of sulphur than the softer rubber products, many thousand articles are made. Among them are battery jars, steering wheel rims, fountain-pen barrels, pipe-stems, combs, and hundreds of articles necessary to the success of electrical appliances. More than 30,000 different articles are manufactured from rubber, ranging from the great hydraulic hose of the gold mines and the conveyor belts of the sugar refineries to rubber bands.

Rubber got its English name from the fact that it was first used as an eraser. It is made from the milky juice, or *latex*, of certain vines and trees that grow abundantly in the tropics. This latex is not the ordinary sap of the tree but is secreted in a network of passages in the inner layers of the bark. When the bark is cut, this fluid, about as thick as cream and slightly pink, oozes out. The trees are tapped and the flow led into cups. If this juice is allowed to stand, little globules of rubber rise to the top leaving a watery fluid beneath, just as cream rises on milk. The sun will presently evaporate the water and coagulate the rubber, but it also rots the rubber, so various methods are used to hasten coagulation.

Until the early part of the 20th century nearly all the rubber of commerce came from the wild rubber trees of the Amazon district in South America and the rubber vines of the African Congo. But more than half of the crude rubber today comes from the great rubber plantations in the Far East—the Malay peninsula, the Straits Settlement, Ceylon, and other islands and from plantations in Mexico and Central America. The world's annual production is nearly 300,000 tons, two-thirds of which is used in the United States, principally for automobile tires. Almost a third of the crude rubber imported into this country goes directly to Akron, Ohio, the greatest rubber-manufacturing city in the world.

The romantic story of rubber begins with Columbus. On his second voyage he saw the natives of Haiti playing ball with an odd elastic substance which bounced much better than the "wind-balls" of Europe. A few years later the soldiers of Cortez found that the natives in Mexico fashioned crude shoes from cloth which had been dipped in rubber latex, and they learned to spread it over their cloaks to keep out the rain. The natives called it "cat-chook," and from this word the name "caoutchouc" was derived, which is the common word for rubber in nearly every language except English. While this strange substance occasioned much interest in Europe, it was not until the middle of the 18th century that some French scientists discovered its true origin.

A BALL OF CRUDE RUBBER



The famous Pará rubber of Brazil is prepared for market in balls like this. The rubber milk is slowly poured on the growing ball while the stick is twirled over a smoky fire, thus causing the milk to coagulate.

In 1823 Charles McIntosh discovered that rubber could be dissolved in naphtha. Spreading this solution over a marble slab to dry, he obtained a very thin sheet of rubber, and this he stitched between two thicknesses of material, making a waterproof garment. This was the beginning of the rubber garment industry that today sends its products all over the world. The same year a sea-captain, returning to the New England states from South America, brought a boat load of the crude rubber shoes of the natives. These became instantly popular, and people willingly paid from $3 to $5 a pair for them.

"KNEADING" THE RUBBER DOUGH

Big milling machines work the rubber and the minerals that are mixed with it into a perfect blend. The rubber emerges from this process in great sheets.

But crude rubber has very serious faults. It softens in hot weather and gives off an unpleasant odor, and in cold weather it gets so hard that it is brittle. Therefore it did not become an important article of trade until Charles Goodyear, about 1844, discovered the process known as *vulcanization*, by which it is combined with sulphur at a moderate heat. On this process the great rubber industry of today rests, for it furnishes a product that is the same under all ordinary degrees of temperature, and does not rot when it is exposed to light and air, as crude rubber does.

This discovery places Goodyear in the ranks of our great inventors. Born in 1800, Goodyear began his life as a hardware dealer, but he devoted all his spare time to the study of how to overcome the defects of crude rubber. He spent all his money and then borrowed more, persisting in the face of general ridicule. Finally, after many failures, he turned his attention to a sulphur and rubber mixture. One day, while he was trying to bake such a mixture, some of the gum fell on the red-hot stove and instead of melting, hardened into a leather-like mass. He took this piece of rubber and nailed it on the outside wall of his house and in the morning found the frost had not made it brittle. He then experimented until he found out how much sulphur should be mixed with the gum and how much heat was required to harden it. Since that time other discoveries have been made, so that we now have both hard and soft vulcanized rubber.

Trees and vines producing the milky rubber juice are found all over the world. They range from the great *Hevea brasiliensis* (sometimes 12 feet in circumference) and *Castilloa* trees of the Amazon basin, which were the original sources of the highly valued Pará rubber; and the *Landolphia florida*, a vine of Africa which for years supplied Europe with much of its crude rubber; to the scraggy guayule bush of the arid plains of northern Mexico. The *Hevea* and *Castilloa* have not only supplied the greater part of the wild rubber, but have been used almost exclusively for the big plantations as well. The household rubber plant (*Ficus elastica*), which belongs to the fig family, is an important Asiatic source of supply.

The wild rubber trees of the Amazon River district grow in swampy forests far from civilization. Sometimes they are 60 feet high and have a circumference of 6 feet or more. Here the rubber gatherers, largely Indians, negroes, and half-breeds, lead a strange remote life. They are hired by an *aviadore*, a man who has secured a grant from the government to tap the trees, for most of the rubber lands of South America are government owned. Each of the gatherers is given a section of forest to work. Often the undergrowth is so thick that he must cut a path from tree to tree. Sometimes the water is deep enough to float the collector's canoe, but many times he must wade in deep mud. He starts out very early in the morning, for if the sun is hot the juice quickly hardens and stops the passage.

MAKING THE TIRE "CARCASS"

The foundation of an automobile tire is called the "carcass." It is made of the finest cotton, and the rubber after being milled is forced into the fabric and around every thread of it by the tremendous pressure of great rolls.

Various methods are used to tap the trees. Formerly the natives cut four troughs down the sides of the tree, or four large V's which met in a common central trough, or sometimes little gashes around the tree, with a cup beneath each gash. But these overtaxed the trees and eventually killed them; so the common method used today is the herringbone system. A vertical trough is cut down the length of the tree, and from this trough are alternating side troughs, slanting at about 45 degrees. The spiral method, in which the wound is run spirally around the tree, is often used. In any method, the cut extends just beneath the outer bark of the tree. At the base of the main trough a cup is set to catch the flow. Every day the collector cuts a thin slice of bark from the lower edge of each lateral trough, opening the clogged passages and renewing the flow. More than a hundred trees are on a "path," the last one bringing the collector back to his hut; and from there he retraces his steps, emptying the cups into a bucket. Often he travels many miles in his day's work. Returning to camp, he starts in on the real work of the day — coagulating the rubber. This must be done at once, for the latex spoils quickly.

The South American has used the same method of coagulation for hundreds of years. He has a sort of furnace, which resembles a jar without ends. A fire is built beneath it, and when it is burning vigorously some palmetto nuts are thrown on, and soon a thick black oily smoke is pouring out. He takes a paddle, dips it into the bucket of latex, and turns it over and over in the smoke until it is covered with a thin layer of rubber. Again and again the paddle is dipped in the bucket until the ball at the end is so large that it cannot be handled. Then it is removed and a pole pushed clear through it. Resting the pole on two forked sticks that have been driven into the ground, the worker turns the ball over and over while more latex is slowly poured on. Larger and larger grows the ball, until a mass about the size of a ham is formed. This is then cut off the stick, and the crude rubber is ready to be shipped by trail and canoe to the nearest river port. Sometimes these "hams" weigh many pounds, and represent many days' tapping. Thousands of men are daily going through this hard lonely routine in the Amazon forests. Pará is the great rubber port of South America, and the best grade of rubber is known as Pará rubber.

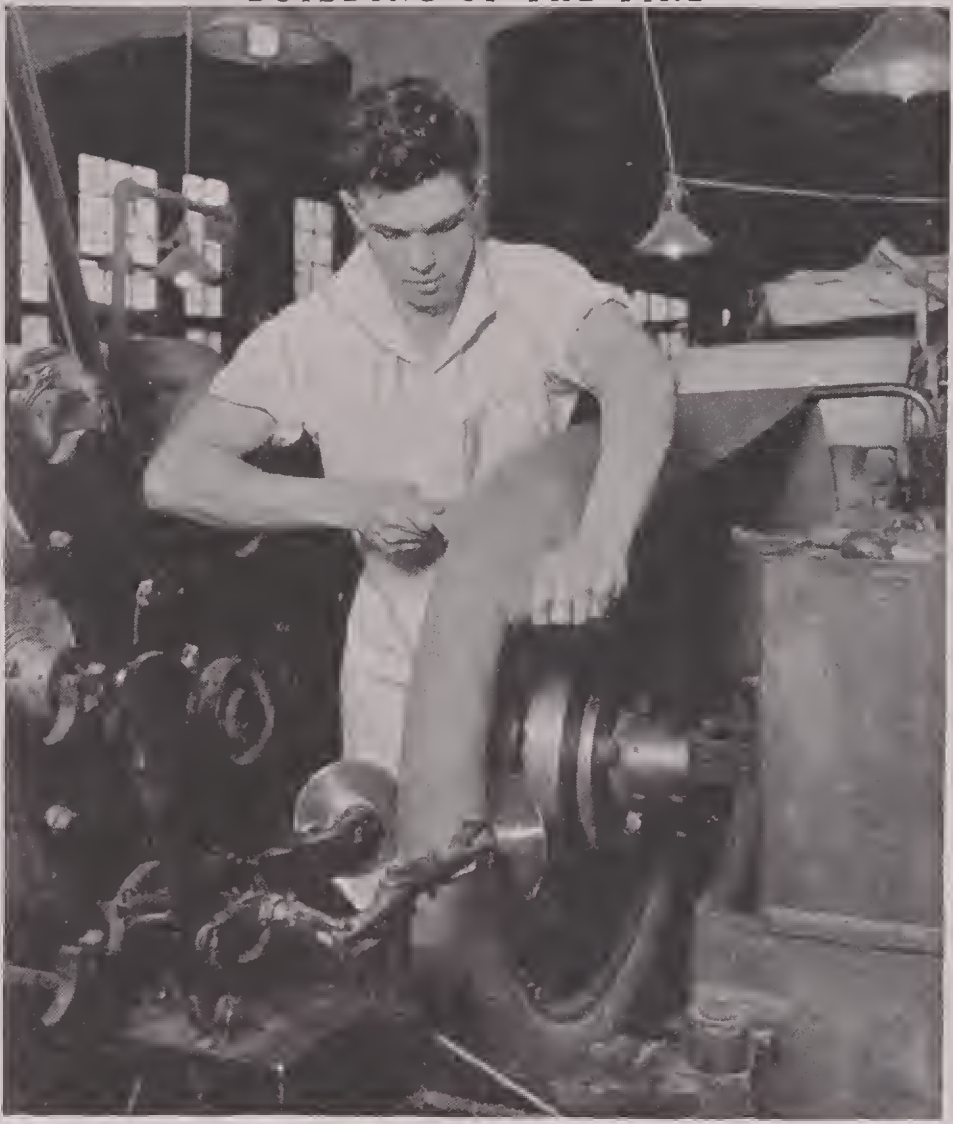
In other parts of the world different methods of collection are used. Much of the African rubber comes from climbing shrubs. The natives, after tapping the vines, sometimes catch the milky juice and smear it over their naked bodies, and when it has hardened pull it off and roll it into balls. In some parts of Asia and Africa the latex is coagulated by means of alum, and in others by boiling it in water. In Mexico and Central America the rubber-producing *guayule* bushes are cut down and ground into pulp, which is churned in water for several hours. Finally the fiber particles sink and the rubber rises to the top and is skimmed off much as cream is skimmed from milk.

In the Philippines rubber vines 300 feet long and 7 or 8 inches thick trail over the tall trees of the forest. The natives pull these down and tap them at places 3 or 4 feet apart, catching the sap in coconut shells and pouring it into sea-water to harden it. The rubber so obtained is white, tough, and elastic, but in a short time it turns black and begins to rot.

Many sinister tales have been told of cruelties practiced in rubber countries, especially in Africa and South America, when the natives did not bring in enough rubber to satisfy their task masters. With the passing of the wild rubber and the increased production of plantation rubber, these conditions have largely disappeared.

On plantations 250 Para trees can be raised to one acre. They begin to produce at the age of about six years. Plantation rubber is gathered and coagulated under ideal conditions, and is shipped to the market practically free from dirt and foreign matter. Wild South American rubber is about 15 per cent waste, while South African wild rubber runs anywhere from 30 per cent to 60 per cent waste.

BUILDING UP THE TIRE



The tire is built up layer by layer over a polished steel core. As the workman draws strips of fabric and rubber sheet over it, the big wheel is turned slowly and the two little wheels at the side help to shape the rubber around the core. This part of the work requires the most expert hand labor.

In whatever form the crude rubber comes to the factory, the first thing that must be done is to clean it thoroughly and test it, as rubber varies greatly in composition. Until it is used it is stored in a cool dark place, usually underground. When a lot is brought up to the manufacturing plant, it is first steamed into a soft plastic mass, and thoroughly washed by being passed through heavy rollers, which mash and knead it between their hot surfaces while water is sprinkled on from above. Finally it comes out looking a good deal like a thin piece of sheet sponge. Vacuum driers take this spongy sheet and extract from it every particle of moisture.

Next it is put into mills which rub and crush it until it loses its elasticity and becomes soft and plastic like putty. In this form it is ready for the mixing room, where the sulphur and other ingredients are added to it. Each product has a special requirement which must be taken into account in the preparation. Some must be hard, others soft; some must stand abrasion, others heat; some will come in contact with acid, others must stand continuous pounding, and still others a steady pressure. Each ingredient is weighed with painstaking care. Then the mixture is rolled between hot rolls, from which it emerges a sheet of prepared rubber about a quarter of an inch in thickness.

Now the rubber is ready for the products factory. Some articles are built up over a rubberized fabric, as hose, belting, automobile tires, and rubber shoes; some are molded, as rubber heels and all hard rubber products; while for the very thin gloves, toy balloons, etc., a form is dipped into a rubber solution made by dissolving rubber in gasoline or benzine. After the

WHERE THE TIRES GO INTO THE STEAM COOKER

articles have been fashioned, they are all subjected to the final step in the vulcanization process — curing under heat. The amount of heat and the length of time depend on the hardness desired.

The pneumatic tire is by far the most important single article of rubber goods manufacture. Two types are made, one over a body of long-fiber cotton duck, and the other over a body of rubberized cord.

Let us follow the making of an automobile tire through the factory. On the first floor large "calenders," which are second in size only to the mammoth machinery of the steel industry, press out the prepared rubber until the sheets are almost as thin as parchment. Between the lower rolls a wide strip of sea-island duck is passing, and the thin rubber from above is pressed down on it. Not only is it pressed, but the rolls by revolving at different speeds set up a rubbing motion, which grinds the rubber into the fiber of the cloth until it is virtually a rubber cloth. As it leaves the rolls, machines cut it into bias strips which are just wide enough to fit over an iron core the exact size of the inside of a tire. These strips are spliced together and several thicknesses are wound around the core. Sometimes the strips are wound by hand, sometimes by machinery. The casings are then built up by putting together the alternate layers of rubber and fabric; the edges are trimmed, and the inner rims are formed to conform to the various models. Finally the casing is ready for its covering of rubber, and the final process of vulcanization. It is put into a mold made in two parts, which are forced together by hydraulic pressure, the

After the tire has been built up it is put into a mold and transferred by carriers to the vulcanizing room. There by the action of steam and pressure, the whole casing is fused together into a tough and resilient tire ready to carry you thousands of miles over city street and country road. In the lower picture the tire is being removed from the mold.

soft gum of the tread being pressed into the non-skid patterns which are on the inner side of the mold. The molds are placed in large retorts or vulcanizers, and heated to 245° F. for a period varying from one to three hours. Sometimes the body and the tread (the running surface) are cured separately and cemented together.

Rubber boots and "rubbers" are made of rubberized cloth, the pieces being cemented together over a metal or wooden last. An outer covering is put over the body, and over the whole a coat of shining varnish. The shoe is left on the mold while it is being cured.

In the room where tennis balls are made we are interested in finding out how the compressed air is put into the ball. First the ball is built up by hand of four sections of prepared rubber, each the shape of a quarter segment. On the inside of the ball is attached a small disk of raw rubber. As the segments are sewed together, a few drops of water are placed on this disk. When this doughy ball is put in its mold to be cured, the heat changes the water into steam and exerts enough pressure to "balloon" the sides against the mold. After the cured ball is removed, compressed air is shot through a hollow needle inserted directly over the green rubber disk, which has not been changed by the heat since it contains no sulphur. When sufficient pressure has been obtained the uncured disk acts as a valve, and closes the hole tightly. The ball is then covered with flannel, cemented, and sewed.

Waterproof clothing is sometimes made of prevulcanized cloth, but garments with a rubber surface, such as firemen wear, are built up first and "proofed" afterward.

It would be impossible to get new rubber enough to make the vast number of articles manufactured every year, but fortunately rubber can be used again and again. For rubber is always rubber, and while sometimes elasticity is lost, it can still be used for a great number of necessary articles. The sulphur and other ingredients are removed by a process known as de-vulcanization. For every pound of new rubber manufactured annually, three pounds of reclaimed rubber gathered by junk dealers are used. The various attempts to prepare chemically a synthetic rubber or to find rubber substitutes have not met with commercial success. (*See also* Gutta-Percha.)

The chemistry of rubber is largely unknown, and offers many problems which will enrich the man who can solve them. Natural caoutchouc is composed of carbon and hydrogen in the ratio of five to eight, and has many points of resemblance to turpentine.

RUBENS, PETER PAUL (1577–1640). "Ah! His Majesty's ambassador occasionally amuses himself with painting!" So exclaimed a courtier of the English King Charles I, surprised to discover the Spanish envoy to England, Peter Paul Rubens, before an easel in his rooms in Whitehall Palace.

"On the contrary," replied Rubens, "the painter occasionally amuses himself with diplomacy!"

Today we think of Rubens only as the greatest of all Flemish painters, but 300 years ago he was nearly as famous a diplomat as artist. He painted masterly pictures of and for crowned heads of Europe; but he was equally skilful in managing delicate affairs of state. Not only was he the master artist of his day, who had learned all that others could teach him and then gone beyond them, but he was also an accomplished courtier and scholar. He was learned in science and politics, and spoke fluently seven languages. Added to this he had a fine presence, and a natural charm of manner that gave him prestige in any court circle.

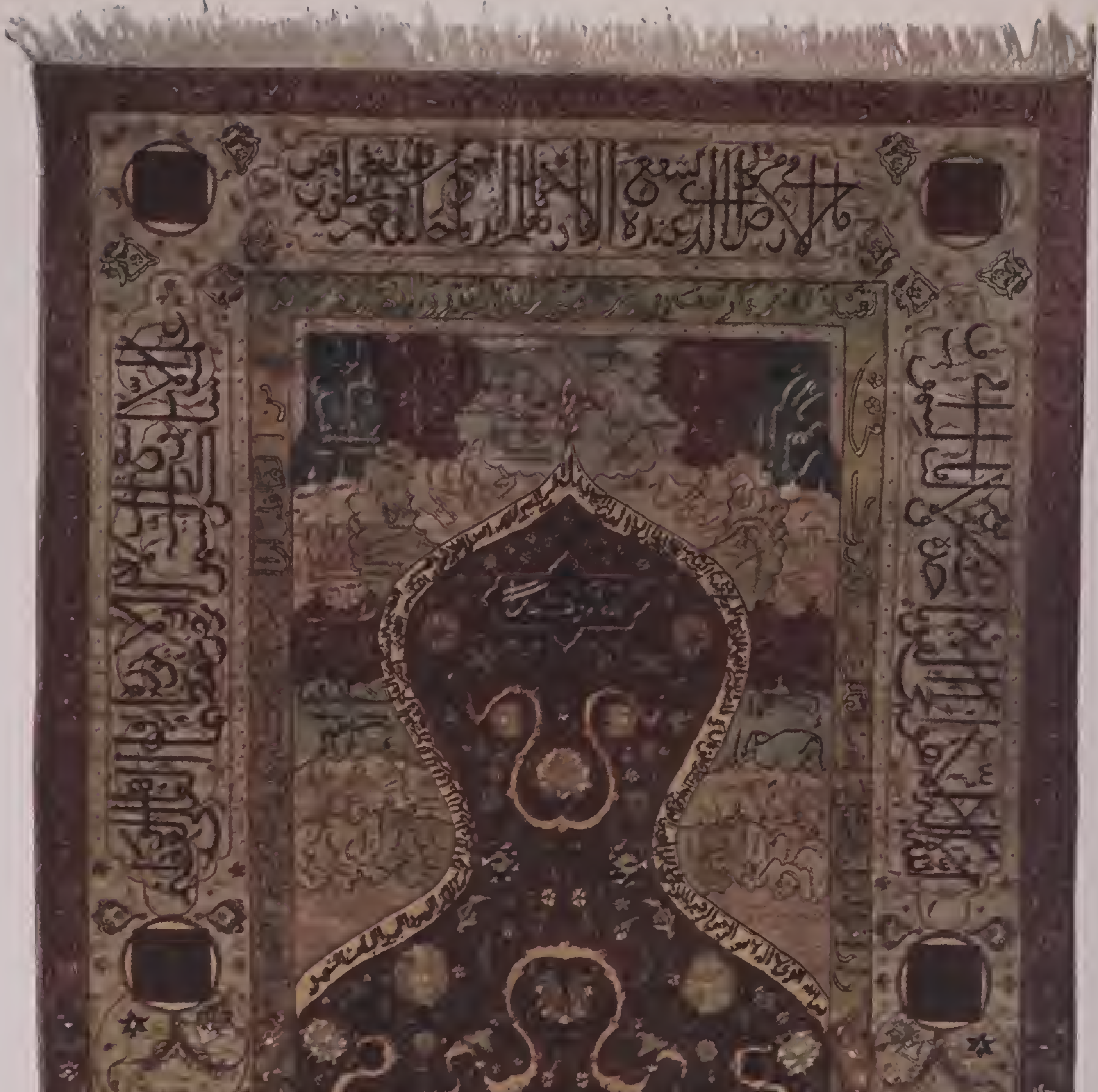
PETER PAUL RUBENS
Painter, Scholar, and Diplomat

"The city of Rubens" is the proud boast of the Flemish city Antwerp. But though a citizen of Flanders during the period that it was a possession of the Spanish king, Rubens was born in Germany during his father's exile from his native land. For eight years he was court painter to the Duke of Mantua in Italy; he was called to the court of France to adorn the palace of the Luxembourg in Paris; and he was knighted by Charles I of England and by Philip IV of Spain when in 1627 he negotiated the conclusion of peace between these two countries. But above all he was the artist who took the best from the art of the Italian Renaissance and united it to the best from the art of the north, adding his own individual coloring and boldness of design to create an art influence that was felt throughout Europe for generations after his death.

In his palatial home in Antwerp Rubens entertained scholars, nobles, and sovereigns. Pupils flocked to him in such numbers that there was always a long waiting list, and orders for paintings came so fast and of such vast size that only the design and finishing touches could be done by Rubens. The filling in was usually done by his paid assistants and pupils, many of whom were themselves masters. Van Dyck, one of the world's foremost portrait painters, was one of the many who served in the Antwerp studio under the guidance of Rubens.

Rubens' private life makes a companion piece to the bright picture of his public career. His domestic life was most happy. He has left charming pictures of his first wife and children, for he used them over

A GEM OF SILK AND GOLD



This Royal Ispahan Prayer Rug, made in the 18th century for the Shah's palace, is one of the masterpieces of the Persian weavers. Its gorgeous and graceful patterns of pure silk and gold thread are mellowed through age. The religious fervor of the Mohammedan religion is expressed in their symbolic and intricate design as well as in the prayer inscriptions so cleverly interwoven in the upper half. So fine is the weave that 1,000 of the tiny knots cover less than a square inch. We may picture a succession of Persian rulers, kneeling upon the broad base of the central design, and bowing their royal heads within that dome-like enclosure, while repeating the words inscribed there: "God, the Greatest of the Great!"

and over as models; while his beautiful second wife, Helène Fourment, is perhaps the most frequently painted woman in history!

Probably no other artist has covered such a vast area of canvas. Rubens delighted in gigantic compositions. He was never so happy as when he was finishing a huge wall painting for a palace or a cathedral. He excelled in every kind of painting. In the 1,300 paintings to his credit, there are animals as skilfully done as if he had spent his life painting nothing else. His landscapes and mythological pictures are masterpieces. His portraits rank among the finest of all ages, and his religious paintings are among the most celebrated in the world of art.

Although it is not known that he practiced the etcher's art to any extent, Rubens exercised a profound influence upon it, through his supervision of etchers who prepared plates from his paintings.

Works by this master are to be found in most of the large art galleries. The famed 'Descent from the Cross' is in the Antwerp cathedral; the exquisite 'Madonna Surrounded by Children' is in the Louvre; the Boston Art Museum has 'The Marriage of St. Catherine'; Chicago Art Institute, 'Portrait of Spinola'; and the New York Metropolitan Museum has five, one of which is the 'Return from Egypt'.

The FINE ART *of the* WEAVER'S LOOM

How Beauty Plays through Warp and Woof in the Rugs and Carpets of the Orient—The History, Art, and Geography of an Exquisite Craft

RUGS AND CARPETS. The oriental rug is almost the sole article of home decoration which we share unchanged with the centuries long past. It is prized today for its beauty, the warmth and vividness of its enduring coloring, and its remarkable wearing qualities, just as it was when it embellished the halls of kings and sultans of a bygone day. And in the mountain districts of western Asia—Persia, Anatolia, and Syria—where the art early attained perfection, rugs are today woven by descendants of the first rugmakers with implements that differ in few respects from those used by their forefathers.

The rug in the Orient is not only floor covering but also wall hanging, bedding, and furniture. Not only was it a source of comfort in the home, but it had a prominent place in religious ceremonies and as temple, mosque, and church decoration. The Mohammedan has his prayer rug which he spreads and kneels upon at the hour of prayer, with the point of the design toward Mecca, the direction in which he bows his head. Rugs are also used as saddle-bags, and trappings for camels and horses. Originally women were the only weavers. Where rugs are not made for the trade, as they are now in many districts, women still are the sole rugmakers. Each weaver has a special design handed down in her family.

PREPARING THE WOOL FOR THE RUG

Before the wool for oriental rugs is carded, it is thoroughly dried and worked up into a fluffy mass. In this process the wool is beaten, as you see. In order to keep it from matting, that large bow you see suspended there is taken down from time to time and held over the wool while its string is plucked violently. The vibrations of the string, striking the fibers of the wool, whip them up again to a fluffy pile.

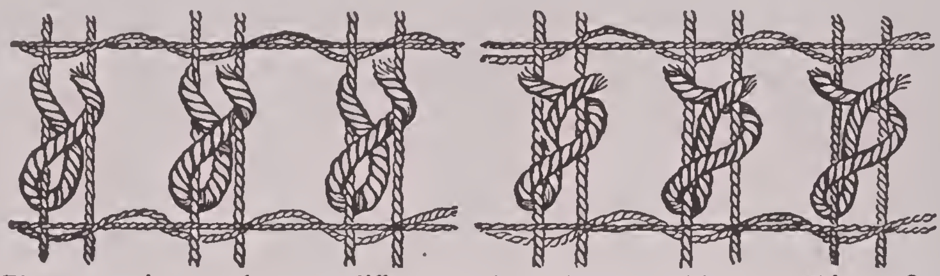
Let us watch one of these rugmakers at work at her loom, which consists only of two upright poles—often they are only straight limbs of trees set up in the ground. These poles hold two horizontal bars, one fastened at the top and the other at the bottom; and to these bars the threads of the "warp," which are usually hemp or cotton, are attached.

The rugmaker first weaves a firm and substantial edge, or selvage, by throwing in and out between the warp threads several rows of "weft," of the same material as the warp (*see* Spinning and Weaving). When the selvage is sufficiently wide (and in some rugs it has a design of its own), the tying of the little tufts which makes the "pile"—that thick soft velvety surface of short protruding ends—is begun. All oriental rugs have this pile, with the exception of the Kelims, which are woven flat like tapestry and are used for wall coverings, and Cashmeres, which resemble the old Cashmere shawls of India for which they are named.

The yarns used may be of wool, camel's hair, or silk or a combination of the three, with sometimes gold and silver threads intermingled. In rugs made in the old way, the yarns are carefully dyed with vegetable colors, according to secret formulas handed down in certain families for generations. Often the dyed yarns are left in the sun and rain and wind for weeks until the dye becomes a permanent part of the fibers of the yarn itself. Colors are thus obtained which in softness, brilliance, and permanence greatly excel those produced by the aniline dyes used by some unscrupulous imitators of the ancient weaves.

The rugmaker uses in her weaving two simple implements—a coarse wooden or metal comb, and a pair of shears; and the operation of tying the yarn so as to make the rug is so simple as to be almost unbelievable when the finished product is considered. She catches up a bit of yarn, winds it about the two warp threads, ties it tightly, and brings it up through so that the short ends will protrude. These ends are then clipped to an even surface. There are two ways in which the knots are tied—the Sehna (Persian) knot, and the Ghiordes (Turkish) knot. The Sehna knot is really more of a twist, arranged so that from each space between the warp threads the end of the pile yarn comes through. The Ghiordes knot, on the contrary, is more like a real knot, both ends of the yarn coming through together between every two threads of the warp. More knots can be tied to the square inch by the Sehna method, and the pile can be trimmed down more closely, as there are no knots or spaces to conceal. The number of knots to the square inch determines the value of the finished rug, and some of the finest rugs have as many as 700 knots to the square inch.

TWO WAYS OF TYING WEAVERS' KNOTS



These two pictures show two different styles of knots used in rug making. On the left is the Sehna knot, used in many parts of Persia, and on the right is the Ghiordes or Turkish knot which is used in Turkey and generally throughout Asia Minor.

Using one or the other of these methods, the rugmaker ties tuft after tuft separately, working out the tedious intricate design with the various colored yarns. After a row has been tied the width of the loom, one or more weft threads are woven across, and pressed down tightly above the row of tied tufts with the comb, to make the work solid and fast. It is the slowness of this hand work which accounts in large measure for the costliness of oriental rugs. All classes are represented among rugmakers—men and women, boys and girls, the people of the towns and the wandering nomad tribes. In Persia, in the Caucasus district, and in many parts of Turkey, rug weaving is the main industry. But in recent years many rugs offered for sale as true orientals are of loose weave, careless design, and poor workmanship, and dyed with chemical dyes.

Oriental rugs are usually classed geographically as Persian, Turkish, Caucasian, Turkoman, Indian, and Chinese. Each of these six main divisions has many sub-divisions, named usually from the various districts of the country. The rugmakers of a district follow a single general design, which all the families copy and have been copying for centuries with slight variations of colorings or size; but usually each weaver puts a great many personal touches into the rug he or she weaves, so that oriental rugs even of the same district are rarely exactly alike. The rugs of all Mohammedan countries are characterized by their geometric or very highly conventionalized flower and animal designs, as the Mohammedan religion prohibits the representation of any form of life.

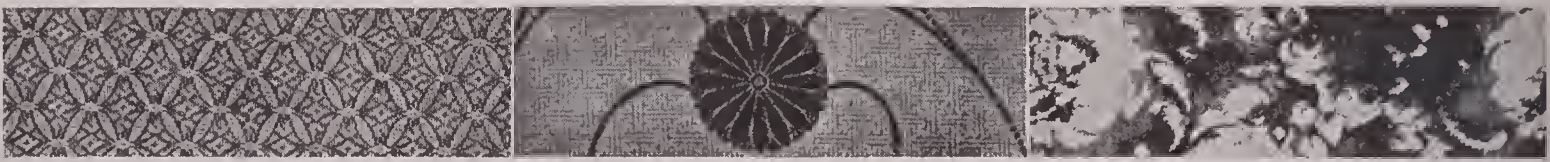
Persia, on account of the great artistic beauty of its rugs and their superior workmanship, attained fame as the real home of the oriental rug as early as the 16th century and has held it ever since. There are at least 14 varieties of Persian rugs, among which are Khorassan, Meshed, Herati, Shiraz, Kirman, Tabriz, Sehna, Serebend, Teraghan, Saruk, Herez, Hamadan, Sultanabad, and Ispahan. The Shah of Persia in his palace at Teheran has a marvelous collection of antiques, among which is the carpet that belonged to the famous peacock-throne at Delhi. Persian designs are characterized by a floral pattern.

The geometric design is carried to perfection in the Caucasian rugs, which show star shapes, circles, fretwork, diamonds, triangles, and various forms of the *Swastika* (卐) in bold design. The rugs listed as Caucasian are Daghestan, Cabistan, Chichi, Circassian, Derbend, Kazak, Guenjes, Cashmere, Shirvan, and Karabagh.

The Kurds combine the designs of Persia and Caucasia in five kinds of rugs, known as Persian Kurdistan, Turkish Kurdistan, Sumak, Mousul, and Kelim. The latter, as stated above, are without pile, and are closely woven in beautiful design and color. They are used as rugs, tent hangings, and blankets.

Among the old Turkish rugs are some wonderfully beautiful ones—the Ghiordes, Kulah, Bergamo,

THREE KINDS OF CARPET EVERYBODY HAS SEEN



Here are three familiar kinds of carpet. The one on the left is Body Brussels. Notice how clear and precise the pattern is. Next is the Wilton, known for its durability as well as its beauty—clean-cut, soft, and luxurious. The third pattern is Axminster, of the "spool" type, which has a loose, soft, and very agreeable texture and is often worked out in elaborate and florid designs.

CARDING AND SPINNING WOOL IN ARMENIA

For carding, a comblike device is used, or sometimes a board with nails driven into it. Much of the spinning is done by shepherds while tending their sheep. They take a good supply of wool with them in the morning and, with simple spindles, spin away hour after hour in the sunshine.

Ladik, Yuruk, Melez, Kir-Shehïr, and Turkish Kelim rugs. Turkoman rugs come from Russian Turkestan and are known as Bokhara or Tekke, Khiva or Afghan, Yomud, and Baluchistan weaves. The Bokharan rugs are marked by a beautiful straight-line pattern and their color is rich and harmonious.

Indian rugs are closely woven, heavy, and of attractive colors, and usually have a large center medallion. The manufacture of these rugs is largely in the hands of American and European firms. The large medallion center and smaller border in green, blue, crimson, and yellow are characteristic of this weave. Beautiful silk rugs come from Tanjore, Masulipatam, and Benares.

Chinese rugs are of surpassing beauty, consisting usually of highly conventionalized designs on a solid field of exquisite shades of blue, yellow, red, fawn, gold, or tan. Some of these rival, in sheen and iridescent gleam, the finest Persian rugs.

In the United States the blankets and rugs of the Navajo Indians compare rather favorably with the productions of the Far East. Colored with native pigments, they wear for years. (*See* Arizona.)

A PERSIAN RUG IN THE MAKING

Do you wonder that Oriental rugs are so expensive, when every thread has to be woven in place by hand? This expert weaver is a Kurdish girl in Persia, wearing the high boots and voluminous short skirts of the national costume.

During the Middle Ages hand-knotted pile rugs were made in Europe in imitation of the imported oriental ones, but owing to the length of time required to make them they could be afforded only by the very rich. The most common floor coverings were ingrains and coarse tapestries, woven on hand looms, and even these were considered luxuries.

Today woven carpets have a considerable use as floor coverings. "Ingrain" carpeting gets its name from the fact that the yarn or "grain" is dyed before weaving. It is made with two colors of yarn, the design appearing in reverse colors on different sides of the fabric. This carpet is now made by machinery and is known as Kidderminster, from the town where it was first made in England, or Scotch, from the place of its origin.

Designs on tapestry carpets were originally made by using many bobbins, each containing a different color (*see* Tapestry). In 1832, however, a method was invented which allowed the patterns to be dyed or printed on a single warp thread before weaving, great care being taken so that the colors came up in exactly the right places in the design.

Hand-woven tapestries and ingrains, however, were flat, having no pile. In the middle of the 18th century a heavy carpet was invented in imitation of floor tapestry, with a thick looped pile made by passing the warp threads over a stout wire which was later withdrawn. Although invented in England this was called Brussels carpet, from the city where tapestry was woven. The figures were formed by warps of different colors that were buried in the body when not wanted on the surface. In carpets of this kind you can usually tell the number of the thicknesses of worsted in the fabric by counting the colors.

Later Wilton carpets were made, in exactly the same manner as Brussels, except that the loops were made over a larger wire, and were cut as the wire was withdrawn. Thus Wilton carpets have a velvet instead of a looped pile. This looped pile method was also applied to the making of tapestry carpets, which, when the loops are cut, is known as velvet carpet. Thus velvet is to tapestry what Wilton is to Brussels.

Early in the 19th century a great improvement in producing carpets occurred when the Jacquard apparatus, used in weaving to regulate patterns, was applied to the hand manufacture of carpets. It was not until later, however, that floor coverings came into general use. In 1841 Albert S. Bigelow, a medical student in Boston, harnessed an ingrain loom to steam power and so increased the output from 8 yards a day to 25 yards. He also patented a power loom for weaving Brussels and Wilton carpets, and another for weaving tapestry carpets. Since then, innumerable improvements have been made in carpet manufacture.

Of machine-made carpets, Chenille Axminsters are the richest and costliest. They belong to the tufted or velvet pile class, the most expensive having piles seven-eighths of an inch high. Most of them are made in plain effects, often with two or three tones; but ingenious machinery has been invented to insert differently colored chenille braid so as to produce the most elaborate designs. Florid and obtrusively colored designs are characteristic of a cheaper variety of Axminster, known as "spool" Axminster.

Rag carpets have been used in America since Colonial days, when every village had its weavers who made up into floor coverings the balls of rag strips sewed together by economical housewives.

Grass rugs, made of tough fibers, have become popular in recent years for special uses. Some have their colors woven into the mesh and some have the decorations stenciled on the finished material.

The United States today makes and uses more carpets than any other country in the world, the manufacturing centering in Pennsylvania, New York, and Massachusetts. In Philadelphia, where the first carpet factory was established in 1791, more carpets of all grades are made than in any other city in the world. They are sent to all parts of the earth.

A YOUNG NATION *and an* ANCIENT PEOPLE

RUMANIA (*rṳ-mā'nĭ-ȧ*). At the beginning of the World War this Balkan kingdom was about the size of Pennsylvania and had about the same number of inhabitants. At the close of that war Rumania was almost doubled in size and population, with 122,000 square miles of territory and about 17,400,000 people.

This region just north of the lower Danube was the Roman province of Dacia under the emperor Trajan, and its present inhabitants claim descent from Roman colonists of that time, and regard their land as "an outpost of Latin culture set in the East." In appearance and language the Rumanians are like the Italians, though with much Slavic admixture. At the end of about 400 years of Turkish rule, during which there were costly struggles also with Poland, Hungary, and Russia, the Treaty of Paris (1856) recognized the two provinces, Moldavia and Wallachia, which lay between the Carpathian Mountains and the Black Sea, as "autonomous" (self-governing) parts of the Turkish Empire. Their coalition in 1861 formed the new nation Rumania (or Roumania, native "Romania"), to which a German (Hohenzollern) king was given in 1866. In 1878 complete independence was achieved. In the second Balkan War (1913) Rumania aided Serbia, Greece, and Montenegro against Bulgaria, and was rewarded by a slight extension southward of the district on the Black Sea known as the Dobrudja.

Sheepskin coats and heavy wrappings for the legs are necessary in the bitter winters of Rumania. This peasant is equipped to defy the winds to do their worst.

In the World War of 1914–18 Rumania disappointed German hopes by siding with the Entente-Allies. As a result it was terribly ravaged by a German-Austrian-Bulgarian army in 1916 and forced to sign a humiliating peace. But when the Central Powers were finally defeated, the Treaty of Versailles (1919) rewarded Rumania by giving her the former Hungarian territory of Transylvania (west of the Carpathians), the former Austrian district of Bukovina (on the north), and Bessarabia (across the River Pruth to the east), which had been a part of Russia. In Transylvania especially the Rumanians form a decided majority of the population, and this reunion with the parent land gratified a strong

AN OIL VENDOR IN RUMANIA

Although the Rumanian oil fields are among the most important in Europe, the system of delivery from house to house is quite primitive. Women carry the oil from door to door.

nationalist sentiment among its inhabitants. (For map, *see* Balkan Peninsula.)

More than 80 per cent of the population are engaged in agriculture, and the peasant-owned farms rarely exceed 20 or 30 acres. The rich deep soil of the Danubian plain, which makes up the bulk of the eastern half of the enlarged Rumania, is similar to the famous "black soil" of southern Russia and makes Rumania one of the great wheat and corn growing centers of the world. Other important crops are beans, potatoes, sugar beets, and tobacco. The hill region between the plain and the mountains is well adapted to fruit growing, and Rumania is noted for its red and white wines and its plum brandy. The forests which clothe the slopes of the towering Transylvania Alps (part of the Carpathian system) furnish abundant timber, and the mineral resources—rock salt, coal, marble, petroleum, etc.—are very great. The Rumanian oil fields are among the most important in Europe, and are one of the chief resources of the kingdom.

In winter the bitter Russian winds send the thermometer below zero, and for three months the broad spacious Danube, Rumania's chief artery of commerce, lies ice-locked. The summers, on the other hand, are tropically hot. Water buffaloes and slow-moving oxen are the chief draft animals. The extensive railroad system is owned by the state. At Cernavoda a great bridge 12½ miles long crosses the Danube and its wide marshes, carrying trains from the capital Bucharest across "the stony region" (*Dobrudja*), which separates Rumania proper from its chief Black Sea port, Constantza.

To the west of the Transylvanian Alps lies the rich and picturesque upland region of high mountains and valleys called Transylvania, now redeemed from Magyar (Hungarian) rule. About a fourth of the land is used for agriculture, rye, wheat, oats, corn, and potatoes being the chief crops; fruit raising is extensive; and there are vast pastures for sheep, cattle, and horses. Forests of coniferous trees, beeches, oaks, etc., clothe the mountains and comprise nearly two-fifths of the total area. Transylvania also is rich in minerals—salt, gold, silver, iron, lead, copper, and lignite. The population is about 60 per cent Rumanian, about 30 per cent Szekler (Magyar), and 9 per cent "Saxon" (Germans, whose ancestors entered the land in the 12th century). The chief cities are Kolozsvar (population, about 61,000), Kronstadt (42,000), and Hermannstadt (32,000).

"GUSHER" IN RUMANIA

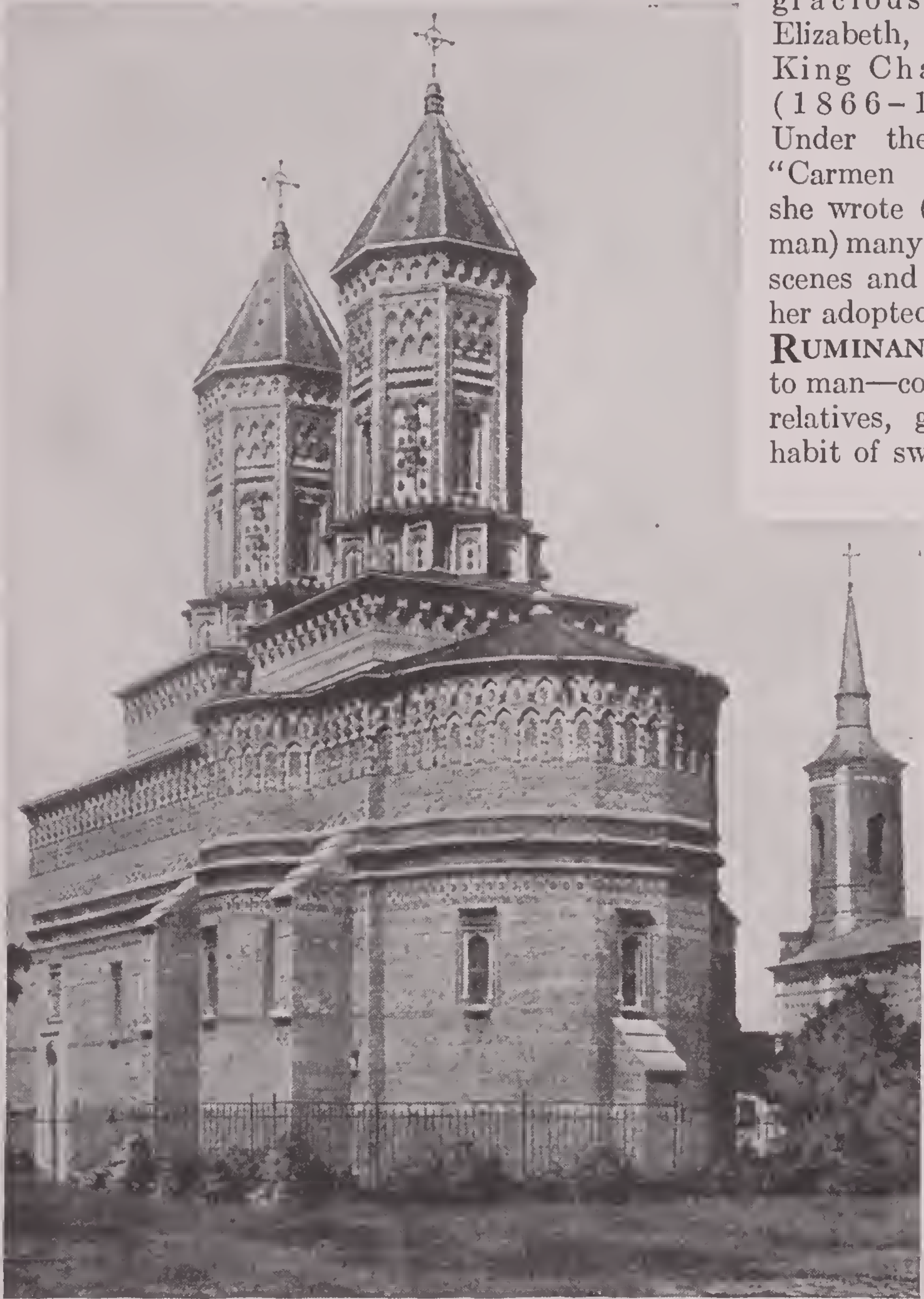
Here is a typical "gusher" in Rumania's extensive oil field at the foot of the Transylvanian Alps. Her petroleum is one of Rumania's principal assets, but foreign capital exploits a large proportion of it.

The Orthodox Greek church, to which a majority of the people belong, is the established church of Rumania. One-twentieth of the total population, a larger ratio than in any other country of the world, are Jews. Rumanian bitterness against them was chiefly due to economic reasons. In addition to political disabilities there were formerly very stringent laws against Jews' owning land outside of the towns. True Rumans or Vlachs make up about 80 per cent of the total population. Other inhabitants of foreign descent are Armenians, gipsies, Greeks, Turks, Tatars, Magyars, Serbians, and Bulgarians.

The peasants, who are generally illiterate, speak Rumanian; the educated and upper classes, French. Bucharest, the capital of Rumania, with a population (about 340,000) roughly equal to that of Kansas City, is thoroughly Latin and very gay. Jassy, the former capital of Moldavia, is second in political importance to Bucharest. Constantza, on the Black Sea, and Galatz and Braila, at the head of the Danube delta, are busy ports for the export of grain, timber, and petroleum. Most of the manufactured articles which Rumania uses come from foreign countries.

One factor in keeping the Rumanian people loyal to their dynasty, in spite of its German origin, was the widespread love inspired by their gracious queen Elizabeth, wife of King Charles I (1866–1914). Under the name "Carmen Sylva" she wrote (in German) many poems and stories dealing with Rumanian scenes and folklore, and was untiring in behalf of her adopted country.

A FAMOUS CHURCH AT JASSY



This church at Jassy, the second city of Rumania, is a curious example of the Byzantine style of architecture. It was begun in 1639. Notice its twin towers, and the countless gilded carvings that adorn the outer walls.

A RUMANIAN BRIDE

How picturesque she looks, this buxom little Rumanian peasant girl in her bridal dress! With a mirror before her, she is decorating her dark hair with a wreath of flowers.

RUMINANTS. Nearly all the mammals most useful to man—cows, sheep, goats, camels, llamas and their relatives, giraffes, deer, and antelopes—have the habit of swallowing their food and later bringing it back to the mouth to be thoroughly chewed at leisure. Hence they are called the "cud-chewing" animals or "ruminants." Their ancestors, being an easy prey to the stronger fiercer flesh-eating beasts, many thousands of years ago took to protecting themselves by swallowing their food hastily in the open places where it had to be cropped, and retiring to more concealed positions to chew it at leisure.

This they are enabled to do by their complicated stomach with four compartments—the paunch, the reticulum or honeycomb bag, the manyplies, and the true stomach. The food when first swallowed is in the form of a coarse pellet which goes into the paunch. There it is softened and passed into the reticulum, where it is molded into pellets of convenient size. Later these are passed up the oesophagus into the mouth by a process the opposite of swallowing. After careful mastication they are swallowed again, passing into the third stomach or manyplies, and finally into the fourth compartment or true stomach. The camels differ from other ruminants in having no third stomach.

RUSHES. The tall slender plants looking like overgrown grass stems, which are usually found in marshy ground, are called rushes. Most of them have no branches and few leaves, while their green shafts are hollow or filled with pith. There are 250 species of true rushes. The commoner kinds, such as the bulrush, are used in many parts of the world for basket-work, chair-bottoms, mats, ropes, etc., while the pith formerly served as wicks in oil lamps and tallow candles, called for that reason "rushlights." The stems of "horse-tail" rushes contain a large quantity of silica or sand, which makes them useful for scouring metal and other hard surfaces, hence they are often called "scouring" rushes. Early geological formations show that rushes used to grow to immense size in great forests. These prehistoric rush forests form many of the coal beds of today.

Scientific name of rushes, *Juncaceae*. The horse-tail rushes belong to the single genus *Equisetum*, placed in the division *Pteridophyta*. They are relatives of the ferns.

JOHN RUSKIN
The Great English Art Critic

RUSKIN, JOHN (1819–1900). Surely you know the charming fairy tale of 'The King of the Golden River', with his hair all of spun gold, his twinkling eyes, and his coppery nose, and of how he helped the kind-hearted Gluck and turned the wicked brothers into black stones. The Englishman who wrote this story, John Ruskin, was not unlike the kind Gluck himself, for when his father had left him a fortune of a million dollars he gave almost all of it away to found art museums and charitable institutions. The story ends, "And Gluck went and dwelt in the valley, and the poor were never driven from his door; so that his barns became full of corn, and his house of treasure." Though Ruskin never got back his treasure, like Gluck, he certainly never was in want, for his writings brought him in $20,000 a year.

From the time Ruskin was a small boy until he was about 40 years old his writings, which were many, were all about art, mostly about painting and architecture. His 'Modern Painters', 'The Seven Lamps of Architecture', and 'The Stones of Venice' gave the people of Queen Victoria's reign a new interest in art and a new point of view toward it.

But when he was about 40 he began to be more interested in humanity than in art and he became a social reformer. His writings changed, and began to describe what he thought would be an ideal state of society and how he thought this could be brought about. He was not content with writing, and he founded all sorts of institutions and model experiments, which unfortunately all failed except one art museum. The truth seems to be that, while Ruskin really knew a great deal about art, though he never looked at it with the eyes of an artist, he knew comparatively little about sociology or economics. So he was really more successful in his early writings than in his later ones, though 'Sesame and Lilies', a popular statement of some of the simpler of his sociological ideas, is also very well known.

Almost as important as the things Ruskin said is the *way* he said them. He wrote beautiful clear English, at times very simple and straightforward, and at times rather highly decorated and colored; but always beautifully, so that he has helped many a young writer to learn how to use the language.

Ruskin was born and lived in England, but his parents were Scotch. His father was a wealthy wine merchant, and as John was their only son, the parents devoted themselves almost entirely to his education, traveling with him through Europe. Some of the best artists in England taught him drawing and painting. Later he went to Oxford, where he took a prize for poetry, and was graduated in 1842. In his later life he was professor of art at Oxford until his health failed and he retired.

His autobiography, 'Praeterita', tells of his early life. His works amount to more than 50 volumes. Aside from those already mentioned the best known is probably 'The Crown of Wild Olive'.

RUSSELL, JOHN (1792–1878). "Woburn, Aug. 18, 1803. This is my birthday. I am 11 years old today." This is the first boyish entry in a great mass of journals and memoirs in which John Russell, Whig leader and twice prime minister of Great Britain, recorded his long and eventful life. He tells us of his school-days at the University of Edinburgh, of his travels on the Continent, and of his entry into Parliament in 1813, at the age of 21.

The most exciting part of the story occurred in 1832—the year of the great Reform Bill. The Tory Duke of Wellington had been forced to resign as prime minister, because he was opposed to the reform of Parliament. The Whigs (Liberals) then came into power with Earl Grey as prime minister. Lord John Russell was given the task of championing the measure which did away with the "rotten boroughs" (where few or no people lived) and gave representatives to the new manufacturing cities, which had not been represented in Parliament. The bill also increased very modestly the number of people who might vote. The House of Lords rejected it. In the meantime the greatest excitement prevailed in the country. Elections were held, and mobs demanded "The bill, the whole bill, and nothing but the bill." Finally the Lords were forced to yield by the threat that enough Whig peers would be created to give the necessary majority in their house.

The rest of the story was less eventful. His share in the great political and humanitarian reforms that followed was unimportant. No great laws were passed in Russell's first term as prime minister (1846–52), and his second term (November 1865–June 1866) was too short to allow him to accomplish anything.

By this time he had lost much of his popularity in the country. His sympathy with the South during the American Civil War led the friends of America to believe that he had purposely allowed the Confederate cruiser *Alabama* to escape in 1862 (*see* 'Alabama' Claims). The mismanagement which marked England's entrance into the Crimean War (1854–56) was blamed on him, and his policy as secretary of state for foreign affairs did not meet with the approval of the country.

Russell—Earl Russell since 1861—was as prosaic a writer as he was a speaker. As one of his fellow-workers once said "it is seldom that languid Johnny turns to glorious John." When he retired from public life in 1866, at the age of 74, Gladstone took his place as leader of the Liberal party.

MIGHTY RUSSIA'S RISE *and* FALL

RUSSIA. When the czars ruled "all the Russias," the Russian Empire extended over 165 degrees of longitude and embraced one-seventh of the land surface of the globe. This was a territory greater in area than the United States, Canada, and Alaska combined. Its greatest east-and-west length was more than twice the distance from San Francisco to New York. Its greatest breadth north to south, from the Kara Sea to the Pamir Plateau in Asia, was about the distance from the southern tip of Florida to the northern tip of Newfoundland.

This mighty Russian Empire included, in Europe, first, the three historic Russias—Great Russia, a huge triangle with its base on the Arctic Ocean and its apex on the upper waters of the Don; the swamps and forests of White Russia, west of the lower half of the triangle; and to the south, wedged in between White Russia and the apex of the triangle, the fertile grain-fields and blooming gardens of Little Russia or the Ukraine. Around these was a fringe of originally alien territories—to the west Finland, the Baltic Provinces (Esthonia, Latvia, and Lithuania), and Poland; to the south, bordering on the Black Sea and the Sea of Azof, provinces which included Bessarabia, the Crimea, and the territory of the Don Cossacks; and eastward, extending to the Caspian Sea and the Ural Mountains, were the Kalmuck and Kirghiz steppes of Astrakhan and the lower Volga basin. About three-fourths of the empire, however, and about one-sixth of the population were in Asia. Stretching away from the Ural Mountains to the Pacific Ocean was the vast territory of Siberia, with various southward extensions which brought the Russian double-headed eagle to the borders of Manchuria and Mongolia in the east, and of Afghanistan and Persia in the west. In the neck of land between the Black and Caspian seas was the province of Caucasus, with formerly independent Armenia and Georgia. The keystone of the whole huge structure, the center from which radiated Russian authority and influence from the time the Muscovite princes expelled the Tatars, was Great Russia or Muscovy, with its capital either at Moscow or at Petrograd (St. Petersburg). All the other "Russias" and Russian dependencies were additions made to it bit by bit. (For maps, see Asia; Europe.)

In the chaos that followed the dethronement of the Czar and the revolution of 1917, Finland, Esthonia, Latvia, Lithuania, Poland, the Ukraine, Georgia, Azerbaijan, parts of Siberia, and other regions broke away from the control of Moscow. The name "Russia" attached to the region of which Moscow

IN THE BLEAK SNOW-BOUND NORTH

These dwellers on the "tundras" of northern Russia are fishers and hunters, whose wealth is chiefly in their reindeer herds. In the distance are the stunted Arctic forests.

RUSSIANS OF THE FAR SOUTH

This smiling round-faced peasant woman of the Caucasus, with her bare feet half buried in straw, is preparing fodder with a rude chopping machine.

was the nucleus—a territory about one-fourth the size of the old empire, but still many times the size of the next largest European country. Russia acknowledged the independence of Finland, the Baltic countries, and Poland, but other states tended to gravitate back within the Russian sphere of influence, either as closely allied or federated republics or as integral parts of the Russian state. Instead of the 8,417,118 square miles of territory and 178,378,800 population included in the Russian Empire of 1914, the new Russia in Europe alone was less by at least 500,000 square miles and 40,000,000 population, and no one could say what the figures were in Asia.

The flatness of Russia and the huge scale of its plains, rivers, lakes, and forests distinguish it sharply from the smaller countries of western Europe with their broken and varied surface. Its watery fringe of lakes and marshes on the north and west it shares with Finland and its other western neighbors. Like the struggling countries of middle Europe, its free economic development, compared with that of the Atlantic and Mediterranean coast countries, is hampered by difficult access to the great ocean highways. Of the four land-locked seas on which it has a foothold, the Caspian has no outlet, the exits of the Black and the Baltic are commanded by other countries; while Archangel, the port of the White Sea (an arm of the Arctic Ocean), is icebound for most of the year. Curiously enough the "Murman Coast" of the Arctic, although 300 miles farther north than Archangel, is so warmed by ocean currents that it is ice-free the year round, and in the great World War a railway to its ports was hastily constructed for the importation of military supplies.

Russia's great rivers to some extent compensated for its failure to reach open seas. During its early history, the Dnieper linked Russia with Byzantium (Constantinople), the Volga with the Caspian and Asia, and the Neva and the Volkhof with western Europe. The main water-parting is the low plateau called the Valdai Hills, about 200 miles south of Petrograd, where rise the great highway streams of the Don, the Dnieper, and the Volga. Short canals connecting the great river systems make it possible to pass by water from the Black or the Caspian seas to the Baltic, and from the Caspian all the way to the

Arctic Ocean. In midsummer, however, the volume of water in many of these rivers is insufficient for navigation, and in winter their frozen surfaces are highways only for sledges. Yet even down to the outbreak of the World War, the cheap transportation furnished by the 50,000 miles of navigable rivers and canals was important for internal commerce, especially because of the underdevelopment of railroads.

A TRAIN ACROSS THE STEPPES

Not unlike a view on some railway of the western United States or Canada is this picture of a train crossing the steppes. But that queer little engine, if nothing else, would tell you this is no American railroad.

Like the North American Great Plains, Russia has a continental climate, with wide extremes of temperature—long cold winters, hot summers, scanty rainfall, and dry winds sweeping unchecked over the vast expanses of plains. Most places in the interior, therefore, have a much harsher climate than places on the same parallels of latitude in western Europe. At Moscow, where the mean January temperature is 14° F. and the July mean 66.5°F., the mercury may rise to 100° in July. There is, of course, considerable diversity of climate in a country which extends from the Arctic zone into the latitude of northern Italy. Olives and figs grow in the far south; only reindeer moss, lichens, and stunted shrubs on the frozen tundras or treeless wastes of the Arctic coast.

There are, from north to south, three great belts of natural vegetation: first, the marshy tundras which border on the Arctic Ocean; then great forests of conifers, birches, and other northern trees; and farther to the south the vast rolling grassy steppes, fertile and luxuriant on good soils, and barren on the bitter alkaline soils near the Black and Caspian seacoasts. No other natural feature is so distinctively and impressively Russian as the steppes. To natives of the "tight little countries' of western Europe they are often melancholy and oppressive in their immensity, but American plainsmen can understand the enthusiasm with which Russians regard their beauty, more subtle and changeful than that of the sea. Before the World War enormous herds of cattle and horses and great flocks of sheep grazed over the fertile steppes. Russia raised about half the horses of the Continent, and more farm animals than any other country of Europe.

Between the steppes and the forest zone, and particularly in what is known as the "black earth belt," lies the most productive region of agricultural Russia. The "belt" itself, running from the Carpathians into western Siberia, lies chiefly in Little Russia or the Ukraine, but there are islands of the same soil here and there outside the belt. This rich black earth, from two inches to six feet deep, at its best is practically inexhaustible; grain has been raised on it for 50 consecutive years and more without fertilizer. It was the wheat from the black earth region that made Odessa one of the world's great grain ports. Among the other important crops in normal times are potatoes, oats, barley, rye, flax (Russia used to furnish the world with four-fifths of its flax), hemp, and sugar beets. Rice and tobacco are raised also.

From the forests of the north, particularly from the Dvina basin and eastward, came lumber, wood pulp, tar, turpentine, resin, and furs. The Russian rivers abound with fish. Most Russian caviar (salted and prepared sturgeons' eggs) comes from the Volga and the Caspian. The fisheries of the Arctic Ocean and the four seas had attained considerable importance before the World War.

A RUSSIAN PEASANT CART

Aside from the costumes of the country people, nothing is more characteristic of Russia than the many peculiar types of carriages, carts, and sleighs.

From the Urals (*see* Ural Mountains) came 95 per cent of the world's supply of platinum, besides iron ore, gold, silver, and copper. The iron deposits are believed to be the greatest in the world. The fact that the coal supplies of the empire came chiefly from South Russia (the famous Donetz basin in the Ukraine, also rich in iron) and that Baku was one of the world's great petroleum-producing centers made retention of these regions, or at least the maintenance of such relations as would ensure against hostile trade barriers, vital to the Russian state. The Donetz basin in

THE THATCHED HUT OF A CAUCASUS PEASANT FAMILY

This dilapidated hut of thatch and half-plastered logs is eloquent of its inhabitants—the peasants of the Caucasus, who do all things in the ways of their forebears. Living in a land blessed with a bounteous soil and a genial climate, they have made but little material progress and are subject to the oppressions of poverty and evils due to ignorance.

southern Russia and the Caucasus region were formerly the world's chief source of manganese.

The Russian city population, small even before the World War in proportion to the vast masses of illiterate agricultural peasants, was greatly reduced during the revolutionary years. The rural regions before the war were thinly populated and the land, as a rule, poorly cultivated. The state, rich landlords, and the Russian church owned enormous estates; the ordinary peasant could barely keep body and soul together after meeting his tax obligations.

For several centuries a system of communal ownership of land prevailed, centering in the *mir* or Russian village community, which periodically redistributed the plowlands among the family groups. This led some romantic-minded Russians to contrast the "holy communism" of the Russian *muzhik* (peasant) with the "pagan individualism" of western Europe. In reality the *mir* was similar in its small intermixed landholdings to the "open field" system of the medieval manor, and was a mark of economic backwardness. A moderate Russian writer on economic subjects said of the life of the peasants: "It is not life; it is the slow death of creatures incessantly hungry." Potatoes were their customary food. Sometimes they added to this a thin rye soup or a little cabbage. Meat was eaten only in the greater festivals. Their straggling villages consisted of brown wooden houses like cowsheds, ill-lighted, unventilated, rarely swept, often without beds or bed linen. Tea, which was usually only "boiled water slightly colored," was drunk in enormous quantities. The death rate, especially of children, was very high. The position of women among the peasants was low; according to one of the proverbs: "A woman has lots of hair outside her head, but not much inside it."

THE "MUZHIK" AT WORK

Much of Russian peasant character—patient, kindly, slow-witted, and simple—is expressed in the faces of these men in their baggy peasant costumes.

In 1860 the average size of a peasant landholding was 13 acres; in 1900 it had sunk to about 8 acres because population had increased despite economic conditions. The "land hunger" of the peasants became an element to reckon with after they had been shaken out of their village isolation through army service and had become somewhat more prosperous through the labor of peasant sons and daughters in the newly arising factories, and the prohibition of *vodka* or Russian whisky. The revolutionary movements of 1905 and 1917 originated chiefly in the cities; but after the Bolsheviks seized power in 1917 the peasants were instructed to seize the land of their former landlords. Being compelled to sell their produce to the Bolshevist organization at fixed prices under penalty of forced seizure, however, they reduced their production to the level of their own necessities. Thus the redistribution of the land, while it gave some relief to the peasants, rather added to the general poverty and confusion of society.

The inadequacy of transportation facilities hampered military activities during the World War and contributed to the economic breakdown that preceded the revolution. Vast railway projects, the greatest of which was the Trans-Siberian Railway from Petrograd to Vladivostok (5,435 miles), were carried through during the later years of imperial rule. But horses remained the chief means of travel in rural districts, and the poor roads that spanned the enormous distances were often impassable during the spring and autumn rains.

Peasant handicrafts supplied practically all the needs of the peasant population until late in the 19th century. After 1900 the Industrial Revolution began in Russia, and large factories, producing chiefly textiles, iron and steel, railway equipment, other metal products, and beet sugar, developed in the cities; but not so extensively as to meet all the needs of the great empire, whose trade consisted chiefly of the exchange of raw materials for manufactures.

The Famous Fair of Nizhni Novgorod

Even down to the World War much of the internal commerce of Russia was carried on at the great fairs held once or several times a year at certain of the larger provincial cities. The most famous of these fairs was that held each summer at Nizhni Novgorod, on the great Volga River, 265 miles east of Moscow. Thither came merchants, travelers, amusement seekers and purveyors, from Tartary, Persia, India, Japan, China, Turkey, Siberia, and all the lands of Europe, swelling the town's normal population of 112,000 to several hundred thousand, and transacting business amounting to $80,000,000 a year.

The established religion of "Holy Russia" under the czars was Orthodox Greek Catholicism; but the inhabitants of the empire included, in addition, primitive fetish-worshiping pagans, Mohammedans, Buddhists, Jews, Roman Catholics, Protestants, and members of other Christian churches, as well as a number of curious Russian Christian sects (the Malokani, Dukhobors, etc.). The Russian peasant, though both superstitious and deeply religious, is naturally tolerant. The systematic persecution of "heretics" under the czars was a matter of state policy, though economic factors entered into the persecution of the Jews. The revolution of 1917 established complete religious freedom. The Bolsheviks, though hostile to the church and religion, did not persecute believers, but they consistently excluded priests, pastors, rabbis, and Mohammedan mullahs from all forms of educational activity, from the suffrage, and even from clerical service in many Soviet institutions and in peasant villages, and carried on an active anti-religious propaganda. They realized that religion was one of the strong forces working against their purely materialistic doctrines.

A Sketch of Russia's History

Russia has been called the land of extremes, not only physical, but in her political, economic, and social life. Although the Russians represent the most numerous of the European white peoples, Russia is the most backward of the European countries. Her government has been continuously the most extreme type of aristocratic autocracy, her natural resources and economic life comparatively undeveloped, and three-quarters of her population unable to read.

To the hardships of tyrannical government have been added those of severe extremes of climate, frequent droughts, and uncontrolled floods. Moreover a vast isolation has oppressed Russia. She has been cut off from easy communication with the Western world and its influences; and within her own vast boundaries enormous distances and inadequate means of communication have kept her peoples separated in small and isolated communities, whose interests centered in themselves, rather than in the nation as a whole.

In 1917 Russia possessed only a little more than 45,000 miles of railroad—less than one-fifth the mileage of the United States. Her ports were few and inadequate. This very isolation, however, made it all the more necessary that Russia should continue to be a political unit, and that the individualistic tendencies of her different provinces and social groups should give way to a recognition of their mutual interdependence, and that all should act together for the preservation of the nation as a whole.

The notorious reports of Russia's political institutions have led people to overlook the real spirit of Russia and to accept many erroneous and sometimes contradictory statements about her. She has been called the "Russian Riddle," and people have unthinkingly regarded her as a nation that could not be understood. The character of her historic development, and the nature of the tasks which from the first confronted her, account in large measure for Russia's peculiarities.

A branch of the Slavic people, who later came to be known as the Russians, settled on the western fringe of the East European plain, and gradually moved

GATHERING WHEAT IN THE GOOD HARVEST DAYS

She has just cut a swathe in the flowery wheat field—this peasant woman of Central Russia—and, returning the sickle to her belt, she is preparing to bind up the sheaves. Many of these women who work barefooted in the fields are magnificent types of vigorous feminine beauty.

eastward, occupying and developing this vast stretch of inhospitable country, and passing over the contiguous continent of Asia, finally reached the Pacific. This task of empire building took many centuries and was all-absorbing. In the process of accomplishing it the stronger tyrannized over the weaker, the clever over the ignorant; and the result was the practical enslavement of the great mass of the people, and the institution of a purely autocratic government.

First Gropings for Power

The gaining of new territory was the chief aim of the first rulers, and little thought was given to the improvement of conditions of life within the borders of the empire. This vast plain must have its seaboards, and they must be wrested from other countries. Western neighbors, fearing the young giant country which was growing up on their borders, constantly harassed it, and when it defended itself complained that it was trying to ruin all its neighbors. But still Russia grew and strengthened itself economically and politically.

We know little about these early Russian settlers until the 9th century A.D. By that time they were settled in separate principalities on the Dnieper and the Volkhof rivers, which together formed one of the most important trade routes of the world of that day. These separate groups accepted the leadership of the Grand Prince of Kief, which was a beautiful and progressive city comparing favorably with the cities of western Europe of that period. The Russians had adopted Greek Christianity from the Eastern Church of Byzantium (Constantinople), and culture was beginning to develop in this primitive community. But in the 13th century the Russian principalities were overrun by Mongolian hordes of Tatars who came in from the East. The Russians were subjugated and forced to pay tribute to the Khan of the "Golden Horde" of Tatars. For almost 300 years the Tatar yoke rested upon the Russian people, and then, under the leadership of the Prince of Moscow, they liberated themselves. This new leader became the "Grand Prince" of Muscovy. He welded together the scattered Russian lands, proclaimed himself the Czar of all the Russias, and set about establishing and developing his empire.

At the beginning of the 17th century Russia passed through what is called her "Time of Troubles." Economic distress caused by constant wars had lead to the breaking down of all authority, and anarchy prevailed. Her jealous neighbors on the west, Poland and Sweden, tried to take advantage of this situation and to finish off the sick and troubled country. Again a national awakening came, with the accession of Michael Romanof (1613-1645), founder of the Romanof line, and the "foreigners" were driven out of public affairs.

About the beginning of the 18th century Peter the Great came to the throne (1689–1725), and with him the modern period of Russian history may be said to begin (*see* Peter the Great). He was a man of unusual ability and iron will. He wanted his country to be more European—that is, more cultured and developed. He tried to accomplish this result by force of arms and compulsion. Through long and difficult wars, at terrible loss of life and property, he struggled to get control of the outlets to the great Russian plain on which his empire rested. Through violent changes, which tended to demoralize the people, he succeeded in modernizing his administrative machinery; he organized a modern army, and forced education upon his officers and the members of his court, many of whom could not even read. He required all men to register for service in his army, or for the building of canals and roads, for service in his new capital at St. Petersburg (Petrograd) or for work in the factories which he was the first to introduce into Russia. Those who would not or could not do any of these things were required to pay heavy taxes.

A RUSSIAN TREASURE HOUSE OF ART

The Hermitage in Petrograd, founded by Peter the Great and enlarged by Catherine II, contains one of the finest collections of pictures in Europe, and unique treasures of primitive and Greek art from ancient Scythia and the Black Sea coast.

Peter died in 1725. His work survived a half-century of incompetent rulers, after which there came to the throne Catherine II, the Great (1762–1796), who took up again the task of reform. By 1800 Russia had become established as a modern state, and had taken the first steps in internal development, such as the spread of education, the establishment of means of communication, and the manifestation of some regard for the well-being of the people.

During the centuries of struggle the peasants, who represented the overwhelming majority of the people in this agricultural country, had been burdened with so many taxes to the state, and payments of money and labor to private owners of land, that their status had become that of serfs, or unfree laborers. They were not slaves, but they were not free, being "attached to the soil" and to the individual landlords, whom the state thus set up in order to use their services in the government and army. The first task of internal reform was therefore to make easier the lot of the peasants.

Alexander I (1801–1825) entertained very radical and progressive views of reform. He had already commenced to carry out his reform program when Russia became involved in the Napoleonic wars, which were disturbing the peace of all Europe. Reform was then abandoned, and both Alexander and his successor Nicholas I (1825–1855) were driven into a panic by the developments of the revolutions in Europe, and devoted their attention to protecting Russia against what they considered the corrupting and perverting "western" ideas. All interest in the emancipation of the serfs was suppressed as revolutionary, and even discussion of it was forbidden.

For 40 years, from 1815 to 1855, Russia made little progress. All suggestions looking toward admitting the people to a share in the direction of public affairs were ruthlessly suppressed, though these suggestions had at the beginning of the century come from the ruling monarch himself.

Then in 1853 Russia became involved in the Crimean War, a war originally with Turkey, to whose assistance came both England and France. On account of material conditions Russia met complete defeat, although the operations were on her own territory. The government proved incompetent and corrupt. The people were angered by the continued burdens of war, and the peasant serfs rose against the landowners in many places and burned and pillaged estates. These and like disorders, which had been increasing in frequency for years past, assumed threatening proportions during the war.

Before the war was over a new monarch, Alexander II (1855–1881) came to the throne. He brought the war to a conclusion as quickly as possible, and then announced that reform was to be the order of the day,

ABOVE THE CLOUDS IN THE CAUCASUS

This view was taken from the height of 16,400 feet on the eastern one of the twin peaks of Mt. Elbruz, an extinct volcano and the highest mountain in the Caucasus. At its foot lies a glacier, the source of the Kuban River. This lofty ridge marks the division between Europe and Asia Minor.

and that it was to begin with the emancipation of the serfs. He frankly said that it would be better to have this measure carried out from above than to wait for it to be forced upon the government from below. Commissions were appointed to work out the details of the emancipation, and to prepare other liberal reforms, such as the introduction of elective local councils, a new and modern system of law courts, and larger freedom for the press.

The act of emancipation, issued in March 1861, gave liberty to some 40,000,000 serfs. It was to be a gradual emancipation, in order that both landlords and former serfs might have opportunity of readjustment. The lands assigned to the peasants were less than they had formerly occupied, and they were burdened with heavy redemption payments for them for many years; not until 1905 did these payments come to an end. Neither party was fully satisfied with the terms of the act, which however on the whole was liberal and just.

Other reforms followed, introducing the elective local councils (called Zemstvos) and establishing a modern system of law courts for the administration of justice. Thus three great steps were taken toward constitutional government and the protection of the Russian citizen from the arbitrary acts of an autocratic government.

But the long years of tyranny of rulers and lack of progress had produced discontent, particularly among younger persons who had been educated at the universities, of which there were now eight of large size in Russia. Revolutionary agitation and organization developed rapidly. A small group of such revolutionaries tried to organize an uprising of the emancipated serfs. The isolated, suspicious, and uneducated peasants did not respond, and the attempt failed. But the government authorities were aroused, and the influence of those who were antagonistic to reform was strengthened. When an attempt on the life of the czar was made by an individual, acting on his own account, these anti-reform leaders completely prevailed. Under their influence Alexander II curtailed many of the reforms already started, and allowed others to be carried out only in form. Such repression bred more revolutionary sentiment, and soon the government was fully engaged in the suppression of revolutionary agitation, to the neglect of the deeper welfare of the people. The revolutionary movement culminated in the assassination of Alexander II in 1881 by a nitroglycerin bomb hurled at his carriage. He was succeeded by his son Alexander III (1881–1894) who simply continued his father's policy.

The process of emancipation continued now under conditions that did not insure to the peasant even the limited rights that had been granted in 1861. The Zemstvos continued to develop, but too slowly to meet the needs of the people. The third of the great reforms, the organization of a just administration of the law, was practically abandoned in favor of a return to arbitrary police methods of government. The censorship of the press became more rigid than before. Revolutionary organizations were completely suppressed, but not revolutionary feeling. Discontent grew under persecution, and upon new and increasing grounds.

In 1894, upon the death of Alexander, Nicholas II (1894–1917) succeeded to the throne. Again the educated and progressive leaders hoped that the reform movement might be resumed, particularly as revolutionary activities had practically ceased. The new czar proved, however, to be a man of limited outlook, though possibly of good and kindly intentions. He believed implicitly in the divine origin of his autocratic power, and in its necessity for the welfare of his country. He definitely put an end to all thought of coöperation in reform by calling the petitions for very moderate changes "senseless dreams."

WHERE A CZAR WAS KILLED

This church was built on the exact spot in Petrograd where Alexander II fell on March 13, 1881, when the fatal bomb was thrown, tearing to pieces horses, carriage, and occupants. The bulbous domes, the swelling central arch, and the bold use of ornament mark the Oriental influence so typical of Russian architecture. Throughout Russia this influence contends with the Renaissance style introduced from Western Europe in the 18th century.

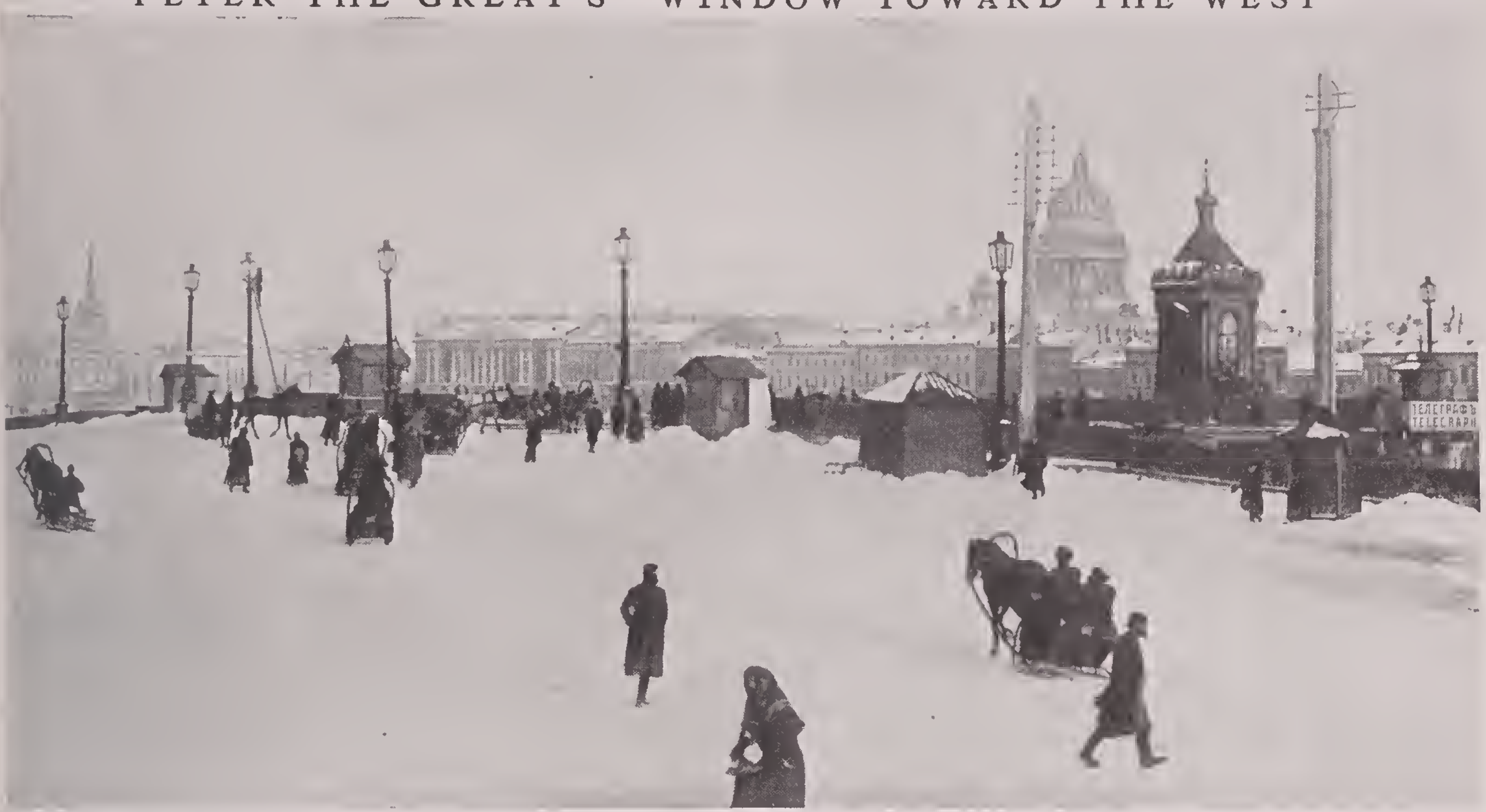
In 1904 Russia and Japan went to war over a dispute respecting rights in the Far East (*see* Russo-Japanese War). The war was not popular in Russia; and when defeat, largely because of the corruption and incompetence of the government, met her armies, and the war was concluded on terms most disadvantageous to Russia, the revolutionary movement began again. A factory laboring class, quite distinct from the peasants, had now arisen and it was organized for action by socialists and revolutionists. Peasants sympathized and helped. There were many mutinies in the army and fleet also. In this emergency progressive manufacturers and landlords demanded measures of reform which would satisfy the just demands of workmen, peasants, and soldiers. Partially successful, they secured at last an elected representative national assembly, called the Duma; but only after a general strike, supported by all classes in the community, and continuing for a week.

The first Duma was convened in 1906. The champions of autocracy were able to bring about its early dissolution. A second Duma was similarly dissolved after a short session, and the election law was changed by the government in such a way as to give the majority of the seats to the large manufacturing interests and the landlords. Though not fully representative, and limited in its powers, the Duma was an important step toward constitutional government. Dominated by property interests, it nevertheless attempted to bring about much-needed reforms, to exercise control over the government, and to protect individuals from arbitrary acts by government officials. The Duma was elected from the people by a group system of voting which secured privileged representation to landlords and manufacturers, and very limited representation to the peasants, workmen, and professional groups. Its sanction was required for the passing of any law, but it had no control over the governmental machinery for the carrying out of the law.

The World War and Russia

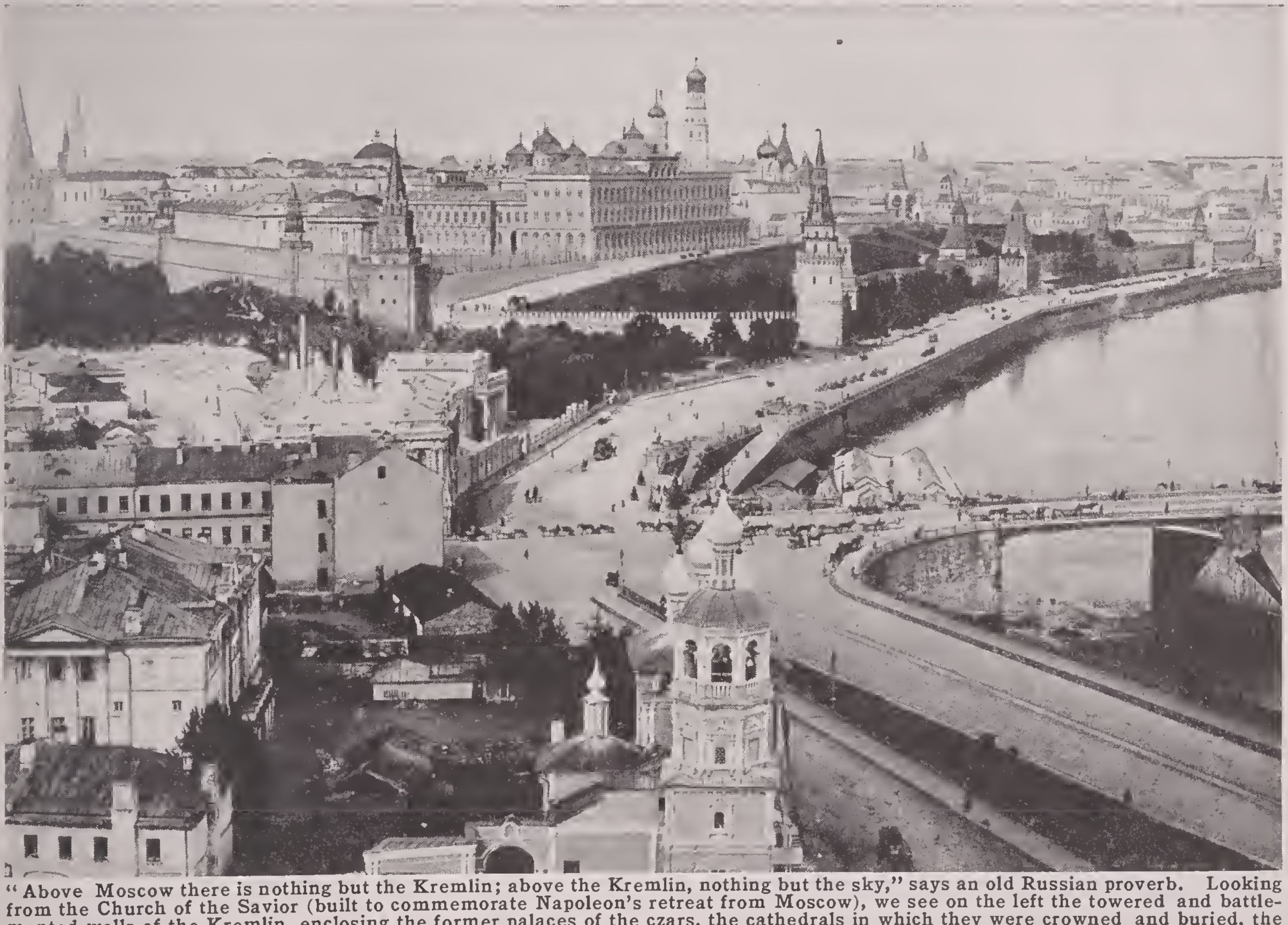
The summer of 1914 saw fresh manifestations of discontent in Russia. Meetings of progressives and liberals, at which resolutions were passed demanding many reforms, were held, and strikes of unusual proportions developed in industrial centers. Revo-

PETER THE GREAT'S "WINDOW TOWARD THE WEST"



Petrograd or, as it used to be called, "St. Petersburg" was founded in 1703 by Peter the Great, in order to give Russia an outlook upon western Europe. We have here a winter scene in the city. On the right, surmounted by its golden cross, is the great dome of St. Isaac's Cathedral, one of the most beautiful and costly churches in the world, with its great rose granite columns.

"HOLY MOSCOW," MOTHER CITY OF ALL THE RUSSIAS



"Above Moscow there is nothing but the Kremlin; above the Kremlin, nothing but the sky," says an old Russian proverb. Looking from the Church of the Savior (built to commemorate Napoleon's retreat from Moscow), we see on the left the towered and battlemented walls of the Kremlin, enclosing the former palaces of the czars, the cathedrals in which they were crowned and buried, the arsenal, etc.; on the right is the Moskva River.

lutionary organizations long since supposedly suppressed made themselves evident. In this atmosphere of unrest came the news of the outbreak of the World War, in August 1914 (*see* World War). To a small group of progressive thinkers it was no surprise. The relations between Russia and Germany, and between Russia and Austria, had been strained for several years past. Russia claimed special interests in the Balkans, which were imperiled by Austrian and German policies. There was also German influence inside Russia, especially in court circles, which was believed to be hostile to reform. This helped to make the war an internal as well as an external one, in the minds of the educated classes. Peasants and workmen at first accepted it without protest; but even among the masses there soon developed the consciousness that the war was a war for liberation, not from aggressive neighbors alone, but from internal tyranny. However, all outward opposition to the government was submerged in the effort of the people as a whole to present a solid front to the enemy.

Russia felt the crushing burdens of the war sooner than other countries. Her economic backwardness and particularly her poor means of communication made her war efforts very costly. Her chief ports of communication with the West, and therefore with her Allies, were shut off from the first day of the war. In spite of such use as could be made of Archangel during the summer season and the construction of a new railway to Alexandrovsk on the ice-free Murman coast of the Arctic Ocean Russia was subjected to a blockade almost as effective as that against the Central Powers; and Russia had always depended more largely than they upon foreign supplies. In this crisis, as many times before, the government proved itself incompetent and corrupt. The most progressive men of the country came forward with offers of assistance to the government in dealing with the problems of the war, but their offers were rejected. The government feared to grant popular participation in public affairs, lest this freedom might lead to permanent embarrassment of the autocratic methods of the government. Great military disasters came to Russia as the result of the failure of the government to supply and equip the armies. Literally millions of Russian lives were sacrificed.

As a result, the attitude of the public toward the government changed, and there were demands—insistent but moderate and genuinely patriotic, and well grounded—for reforms, which alone would enable the nation to carry on the war. The sovereign listened only to the selfish advice of individuals in his immediate government circle, and interpreted all demands as either groundless or definitely unpatriotic. With his approval the government interfered in every way with the activities of the Duma and with the work of special organizations of the people, even those whose activities represented such genuine war work as the care of the wounded. The government's attitude was one of suspicion toward all movements initiated by the people.

THE GREAT BELL MARKET AT NIZHNI-NOVGOROD

Even a modern department store can scarcely parallel this exhibit of merchandise at Nizhni-Novgorod in the days of the old fair.

By 1916 internal discontent, especially in the large cities, had swelled to alarming proportions. The food situation had become critical and prices on manufactured goods had risen to absurd heights. Again attempts were made to secure by petitions political changes which would better conditions, but again the sovereign refused to pay heed.

At Last the Government Collapses

In March 1917 a bad food shortage in Petrograd brought demonstrations of protest accompanied by riots, and the soldiers went over to the people, deserting the government. The Duma, in session at the time although daily expecting dissolution by the government, alarmed by the street riot in the capital, resolved to act to save the situation. They organized a temporary provisional government which was representative in character, and sent a delegation to the czar demanding his immediate abdication. The socialist members of the Duma organized a council of deputies from the workmen and soldiers of Petrograd. This council or "Soviet" (as it was called in Russian) coöperated with the Duma committee in the selection of this first revolutionary government, and in drawing up its platform. Nicholas II abdicated for himself and his son (March 15), and was put under arrest. He and his family were sent to a distant Siberian monastery and in a very short time this last of the Russian czars was practically forgotten.

This revolution of March 1917 was accomplished within a week. The former government machinery in Petrograd collapsed utterly. The rest of the country, and particularly the army, promptly submitted to the new authority. There was little bloodshed, and the revolution was hailed with joy throughout Russia. For a time the government was in the hands of the non-socialist Constitutional Democrats, but in July the power passed to Alexander Kerensky, a brilliant orator of moderate socialist views.

The provisional government had to face a difficult situation. It was one of the most critical moments of the great war without, and conditions were extremely bad within. The leaders determined, however, that the war must be carried on with even greater vigor. A program particularly favorable to the demands of labor and of the peasants was drawn up; but the executive machinery of the new government was not sufficiently perfected, and the people, unaccustomed to political responsibility, did not act as a unit. The economic situation was too bad to be immediately improved, and there were many differing opinions as to the best policy with respect to the war. To continue the conflict meant to increase burdens already heavy. The Russian people were tired out, especially the peasants, and their losses in lives had already reached into the millions.

The Bolsheviks

At this point there came forward a small group of extreme socialists, to many of whom the recent revolution had given the opportunity to return from exile in foreign lands. They urged withdrawal from the war and a new revolution of another kind, a social revolution, the aim of which was to overthrow completely the existing social and economic system, and to establish a new order based on the principles of communism. This kind of revolution would abolish all private property, and establish a dictatorship of the proletariat or workmen. The instrument for such a revolution was to be the "Soviet of Workmen's, Peasants', and Soldiers' Deputies" which had been organized throughout the country, on the model of the one established in Petrograd at the time of the first revolution in March.

ST. GEORGE'S HALL, KREMLIN PALACE

This hall is in the Great Palace of the Kremlin, Moscow, as it looked in the days of the Czars. It is 200 feet long, 58 feet wide, and 70 feet high. Its decorations were in white and gold, the enormous chandeliers of gold, and the polished floor inlaid with the richest woods of the empire.

During the summer of 1917 the champions of this new revolution—the Bolsheviks as they were called—carried on active propaganda among workmen, soldiers, and peasants. They promised peace through the immediate withdrawal of Russia from the war, and to the peasants land through the confiscation of landlord estates, and bread to the workmen through the seizure of the factories. The economic distress and the confusion of mind that existed during these months furnished a fertile soil for this propaganda. Finally on November 9 the Bolsheviks overthrew the provisional government and drove Kerensky from Petrograd. Unlike its predecessor, this was not a bloodless revolution. Riots, assassinations, and measures as autocratic as any in which the czars had indulged were used to further the purposes of the Bolsheviks. The new government which they set up was called "the Russian Socialistic Federated Republic of Soviets." Eight months later the former czar and his whole family—wife, son, and daughters—were brutally shot to death by the Ural regional Soviet (July 17, 1918).

The first political step of the new Soviet government was to arrange an armistice with the Central Powers.

Peace negotiations were soon started, and in March 1918 the treaty of Brest-Litovsk, entailing a separate peace between Russia and the Central Powers, was signed. The Bolsheviks then set about carrying out their revolutionary program. Those that opposed them—even by force of arms—also opposed the peace with Germany which they had signed. On this basis the Allies and America rendered assistance to the anti-Bolshevist movements. Also the Russian Bolsheviks had proclaimed as their goal a world revolution, of which the one in Russia was to be the first step. Specific acts directed toward the overthrow of other governments thus gave to the Bolshevik movement an international aspect which challenged the assistance of other nations in anti-Bolshevist efforts.

The question of policy toward Russia and the Soviets caused sharp dispute in all countries, and particularly in America. Many urged the policy of "hands off" with respect to Russia and the Bolsheviks, on the ground that the movement was an internal affair of Russia. Others emphasized the international aims of the Bolsheviks, and urged not only refusal to recognize them as the government of Russia, but the rendering of active assistance to anti-Bolshevist movements.

The Bolsheviks were able to gain power largely on the ground of their promises to improve conditions for the peasants and workmen. But the economic conditions in Soviet Russia were not improved, even after three years of Soviet rule. There was starvation not only in the cities but in many agricultural districts. Industries had collapsed and means of transportation had broken down. Wars within and without, and the blockade, long maintained against Russia, did not entirely account for this condition. Many observers and economic experts held that the principles of Bolshevism were autocratic and economically unsound, and that these principles were responsible for the economic collapse in Soviet Russia.

LOMONOSOF
Father of Russian Literature

The success or failure of the Bolshevist movement in Russia became of immediate importance to all countries, and particularly to the countries of Europe. The extreme socialists of many countries formally joined a Moscow organization called the "Third International," through which the Bolsheviks were able to carry their propaganda to all lands and assist revolutionary movements in other countries. The reports from Bolshevist Russia, however, even those brought out by socialists and workmen representatives who have visited the new workmen's state, lead many of these same classes, as well as others, to believe that Bolshevism was not the road to better conditions, either in Russia or in other countries. (*See also* separate articles on the chief Russian rivers, cities, and historical characters.)

RUSSIAN LITERATURE. More than in any other land, the literature of Russia reflects the social and political history of the country. Born under the yoke of a monstrous tyranny, the master writers of the 19th century, the golden age of Russian literature, were compelled from the first to struggle against the gross ignorance of the people, the superstition of the church, and the persecutions of the government. They learned the ideals of liberty from western Europe, but they had to write in Russia with a policeman at their elbow. If they painted too vividly the sufferings of the peasants, if they exposed too sharply the corruption in official circles, if they criticized the Russian church, or openly advocated reform and freedom—arrest, imprisonment, and exile to Siberia was sure to be their lot.

Yet this attitude of the government merely gave a keener edge to social and political questionings, and sharpened the pens of the writers with a more bitter satire, with impractical rebellion, with fierce optimism or hopeless pessimism. It thus prepared the way for the Revolution of 1917, which hurled the czar, the "autocrat of autocrats," from his immemorial throne.

Russian is considered next to Chinese the most difficult tongue for foreigners to master. Its grammar is not as simplified as in the Germanic or Romance languages, but is like Latin or Greek, and the alphabet, with many strange appearing letters, adds to the confusion. Like the Bulgarian and the Serbian, Russian is written with the Cyrillic alphabet, derived in the 9th century from the capital letters of the Greek alphabet.

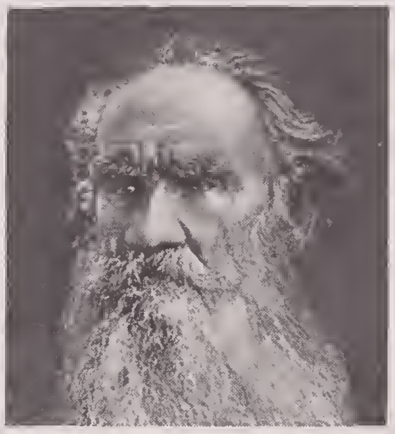
There are three branches in the Russian group of languages: (1) Great Russian, which is spoken in the north, central, and east, and was the official language of the whole Russian Empire; (2) Little Russian, the language of the Ukraine in south Russia; and (3) White Russian, which merges into Polish in the west. Of these, Great Russian alone has been developed and enriched to the point where it has produced a truly great literature. It is chief among the Slavic languages, which include also Polish, Czech, Croatian, Bulgarian, Slovenian, Serbian, and many other tongues.

Great Russian had its origin in the Old Slavic language, which is still the official tongue of the Russian church, and which bears the same relation to modern Russia as Latin does to French or Italian. In this language were written 'The Chronicle of Nestor' and 'The Story of the Raid of Prince Igor', which remain the earliest and the best of the primitive epics which were set down in writing. They date back to the 11th and 12th centuries, when Kief in the southwest was the center of culture and refinement.

But in the 13th century the Golden Horde of Tatars conquered Russia and for over two centuries froze her intellectual and artistic life, building an invisible but real wall between her and Europe. Then, as the new Russian nation formed around the Grand Dukes of Moscow, the intolerant despotism of the new czardom effectually throttled until the 18th century all literary endeavor.

PUSHKIN
Byronic National Poet

Russia, however, could not remain forever cut off from Europe. First from Poland, then from Germany, and later from France and England, the wind of new ideas began to blow. The movement to Europeanize the backward country begun by Peter the Great at the beginning of the 18th century and carried on by Catherine II, the forceful and witty empress of German birth, made the French language and ideas fashionable in St. Petersburg (Petrograd). Meanwhile the versatile genius, Michael Lomonosof, had written the first Russian grammar, and won the title of "father of Russian literature."


TOLSTOY
The Lion of Russian Letters

Although French culture broadened the minds of educated Russians, no voice from Russia was heard in the outside world until that of Alexander Pushkin—the "uncrowned czar of Russian poetry"—rang out at the beginning of the 19th century. For more than a hundred years the literary splendor thus kindled has lasted in Russia.

In no field is Russian literature more notable than in that of the modern realistic novel, of which Nicholas Gogol was one of the founders. Among the greatest of novelists must be classed Turgenief, a supreme master of realistic prose; Dostoyefsky, with his penetrating novels depicting the tragedy of the Russian "intellectuals"; and the giant Leo Tolstoy, towering above all in social and political importance. The artistic standards set by these writers were carried forward by a bold set of followers—Chekhof, with his famous short stories; Gorky, the vivid and colorful narrator of the seamy sides of life; Andréef, the eccentric but powerful mystic, and many other brilliant writers.

KOLTSOF
The "Bobby Burns" of Russia

Through the writings of all these runs the thread of social revolt, the cry sounded in 1849 in the lines addressed by one of Russia's poets to the great founder of Russian socialism, Alexander Herzen—a cry that was reëchoed in countless rebel breasts:

When I was a tender,
  docile child,
When I was a rebellious
  and passionate youth,
When old age was my
  neighbor,
Always, in short, one
  word echoed in my ear:
In my ear sounded one
  word, ever the same—
    Liberty! Liberty!

GOGOL
Founder of Russian Realism

In the first half of the 19th century this cry was in the mouths of the "intellectual" aristocrats, who rebelled scornfully or sadly against the stupidity about them, but offered no particular program of relief. From 1850 to 1870 the cry was taken up by the middle class, the student element, and the "nihilist" movement began—with its appeal to reason, evidence, and science as the sole sources of truth, and its denial of the unsupported claims of tradition or authority as embodied in the church or state. Then came the "populist" period, idealizing the great peasant class of Russia, and entertaining the romantic hope of finding in the simplicity of rural life the germ of justice and equality. "Turn to the peasant," said the leaders of this period, "and he will see the light and make your dreams come true." When the ignorant and superstitious peasant proved indifferent or blind to such visions, a spirit of reaction and despair set in. With some this led to a "decadent" striving in literature for artificial beauty and sensual gratification, stripped of all social significance.

It was not until the 20th century that the voice of the industrial proletariat, the workers in factories and shops, rang out, with Maxim Gorky, the wanderer and exile, as their spokesman. It is this note that sounded loudest in the Russian revolution, and which runs through the Russian literature of today.

GORKY
Preacher of Revolt

Bitter and even morbid as the Russian writers sometimes seem, there is no escaping the sincerity of their realism. Their clear, grim, often exalted spirit has made its way into the modern literature of every land. With a few magic words they call up a picture, a human soul, a mood, which steals upon you like the clear, vivid cold of a winter night. It may be a picture of some black horror of the modern city, or a sketch of fresh fields and happy children; it may be a vagabond in a hovel, or an elegant lady at a gay ball—but the vision is as sharp as an etching and the tone as deep and beautiful as an organ's music. No nation boasts writers who make you see more vividly or feel more deeply.

CHIEF FIGURES IN RUSSIAN LITERATURE

Michael Lomonosof (1711–1765), poet and grammarian; "father of Russian literature."

Basil Zhukofsky (1783–1852), critic and translator of foreign masterpieces.

Alexander Griboedof (1795–1829), dramatic satirist—'The Misfortune of Being Clever'.

Alexander Pushkin (1799–1837), poet, dramatist, and short story writer—'The Prisoner of the Caucasus'; 'The Gypsies'; 'Boris Godunof'; 'Eugene Onegin'; 'The Fisherman and the Fish'.

Alexis Koltsof (1808–1842), greatest Russian folk poet, author of numerous songs and ballads.

Nicholas Gogol (1809–1852), realistic novelist and dramatist —'Mirgorod'; 'Arabesques'; 'The Inspector-General'; 'Taras Bulba'; 'Dead Souls'.

Visarion Belinsky (1810–1848), great Russian critic, author of powerful essays and reviews.

Michael Lermontof (1814–1841), lyric poet and novelist —'The Demon'; 'A Hero of Our Time'; 'The Angel'; 'The Prayer'.

Ivan Turgenief (1818–1883), Russia's master of prose fiction—'A Sportsman's Sketches'; 'Fathers and Sons'; 'Rudin'; 'Virgin Soil'.

Feodor Dostoyefsky (1821–1881), psychological novelist—'Crime and Punishment'; 'The Brothers Karamazof'; 'The Possessed'.

Alexander Ostrofsky (1823–1886), greatest Russian dramatist —'The Thunderstorm'; 'Poverty is No Vice'.

Leo Tolstoy (1828–1910), novelist and philosopher—'War and Peace'; 'Anna Karenina'; 'Kreutzer Sonata'; 'What is Art?'

Anton Chekhof (1860–1904), dramatist and short story writer—'The Black Monk'; 'The Duel'; 'The Cherry Orchard'; 'The Kiss'.

Maxim Gorky (Alexis Peshkof) (born 1868), novelist and short story writer—'Comrades'; 'Lords of Life'; 'Humble Folk'; 'The Mother'.

Leonid Andréef (1871–1919), dramatist and short story writer — 'Judas Iscariot'; 'The Crushed Flower'; 'Anathema'.

RUSSO-JAPANESE WAR (1904–05). Before the days of the World War of 1914–18, this was considered one of the greatest military struggles of all times. It opened a new chapter in the history of the Far East, marking a great era in the national life of Japan and tremendously advancing her power for good or ill. Even the Chinese saw what an oriental people could do in the western game of war, and alternately trembled and rejoiced at Japan's success. The British, who had feared Russia's pressure on India, saw that power go down like a card house before Japan, with whom England was allied.

Japan had been embittered at the close of her successful war against China, in 1895, by the demand of Russia, Germany, and France that she evacuate Port Arthur and the Liaotung Peninsula, ceded to her by defeated China. She yielded, but was rightly angered when three years later Russia calmly seized this territory for herself. Japanese discontent was increased a few years later when Russia made the Boxer troubles in China an excuse for occupying Chinese Manchuria, under pretext of guarding her railroad and other interests there. Japan pressed Russia to keep her promises to withdraw from Manchuria, but Russia quibbled and evaded. A Russian concession for timber-cutting in the Yalu valley was protested against as the beginning of an attempt to bring Korea under Russian control. Nevertheless Russia blindly blundered on toward the inevitable war for which she was far from being prepared.

Finally Japan struck, in February 1904, without a formal declaration of war. The Russian Far Eastern fleet at Port Arthur was torpedoed. The war was on, with Japan efficient and ready, and Russia corrupt, ignorant, and half-hearted. Port Arthur was besieged by the Japanese army under General Nogi and her fleet under Admiral Togo. Japanese armies swarmed into the peninsula and drove the Russians back in unrelieved and disgraceful defeats. The chief disaster was at Mukden, in February 1905, when Oyama defeated Kuropatkin, Russia's greatest general. The Russian fleet from Europe was crushed as soon as it arrived in May in the great naval battle of the Sea of Japan. The single-track line of the Trans-Siberian railroad proved inadequate to bring up supplies and reinforcements. Russia was soon in utter collapse.

Finally President Roosevelt invited representatives of the two countries to confer in America. The treaty of Portsmouth, N.H., signed Aug. 23, 1905, assigned Russia's rights in Port Arthur and the Liaotung Peninsula to Japan, and gave her also the southern half of the island of Sakhalin. Russia agreed to evacuate Chinese Manchuria, and recognized Japan's paramount interest in Korea. Japan, however, abandoned her claim to an indemnity.

By this war Japan became a great military and naval power, while Russia received a blow which contributed materially to the downfall of the czars 13 years later.

RUST. Rust is really an iron ash formed when an iron surface is "burned" by the oxygen of water. You can rub old rust off in a powder as fine as ashes, and it is this iron oxide mixed with soil that gives it its brown or reddish color. It dissolves in water and is taken up and used by plants. Through water and plants, we take iron into our bodies to give us the red color of our blood. John Ruskin said of iron: "It breathes the air, burns itself up in oxygen, and so gives its own life that we may live."

Neither wrought iron nor steel nor cast iron, as usually made, can be exposed to moist air without rusting. When a drop of rain falls on a clean bright surface of iron, for a short time the drop stays clear, showing the bright surface of the iron through it. But soon it takes on a greenish appearance, showing the compound formed by the oxygen in the water with the iron. Presently this compound turns reddish brown. This is rust. The rust does not stick to the iron, but is hung in the water, and becomes a coating only when the water has evaporated. Iron remains quite free from rust in an atmosphere containing water-vapor, so long as the water-vapor does not condense as liquid water on the surface of the iron. But when rust once forms, the iron will go on rusting in an atmosphere in which a piece of clean iron will not rust, because liquid water will condense on rust when it will not on bright iron. Thus it is much easier to prevent the first formation of rust than to stop the process. To prevent rust, oil paint is used, also a zinc coating (galvanizing) and japanning. Kerosene is useful in removing rust from metal.

RUSTS AND SMUTS. Minute parasite plants belonging to the group of fungi called *Basidiomycetes* prey upon our most valuable cereals and cause crop losses that total hundreds of millions of dollars every year. Not only do these diseases reduce the yield, but the harvested grain if smutted or rusted receives a lower grade in marketing or is rejected entirely. Wheat, oats, and barley are the crops chiefly affected, but rye, beans, clover, timothy, sorghum, millet, and some of the stone fruits also suffer seriously. In addition huge losses to the lumber industry are caused by a white-pine blister rust. Rusts and smuts are found practically the world over. So great is the economic injury done that national and state governments are investing vast sums in research into the causes, prevention, and cure, and in educating farmers to coöperate in warring against them.

Like mushrooms and other members of the big *fungi* family, "rusts" and "smuts" reproduce themselves by means of spores, which are dustlike bodies so tiny as to be invisible except under a microscope. (*See* Fungi.) Wheat rust makes an interesting type study. It feeds at different stages on two different plants, which botanists term its "hosts." One host is the wheat plant, the other is the barberry shrub.

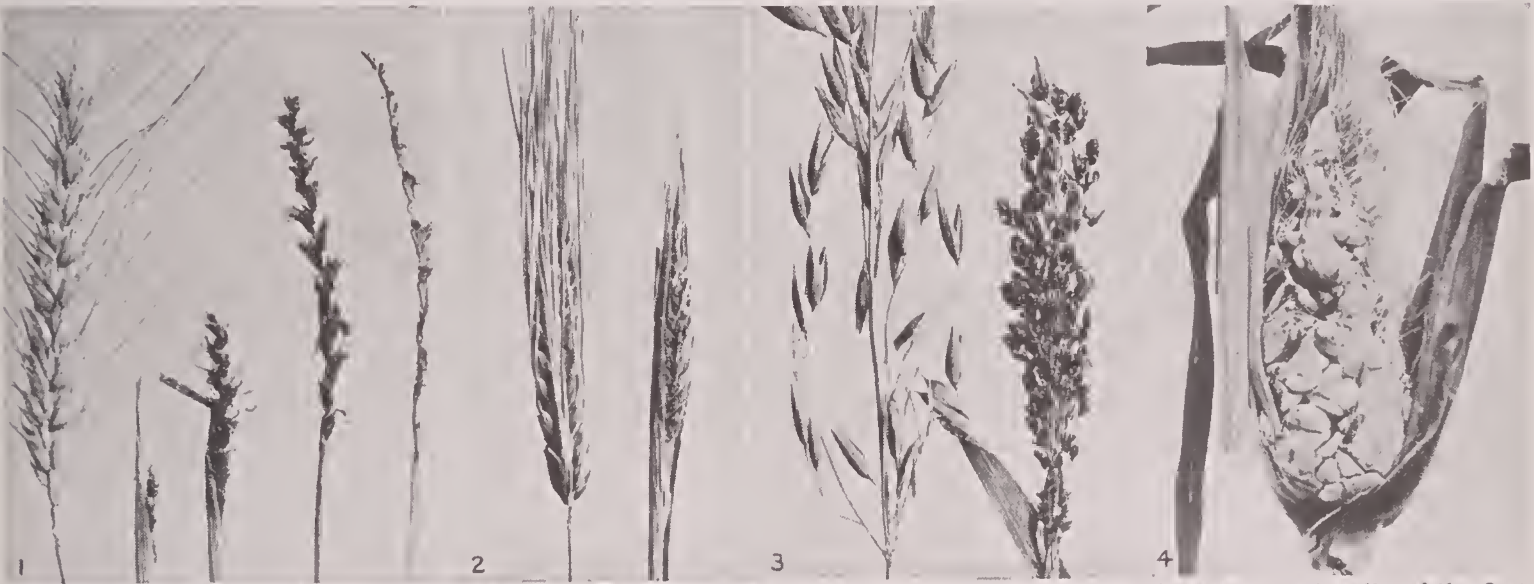
On the under side of the barberry leaf we find masses of orange-colored spores in little depressions called "cluster-cups." These spores, lighter even than dust particles, are easily carried by the wind for many miles. Falling upon the young wheat stalks, they lodge among the living cells and germinate, forming a threadlike mass called the "mycelium," corresponding to the spawn in mushroom culture. By appropriating the wheat's food, this filament flourishes while the useful plant is stunted.

When "Red" and "Black" Rusts Appear

Before harvest time the crop of summer spores appears as rusty-looking lines or dots, usually upon the leaves but sometimes upon the stalk also. This is the "red rust" of wheat. Scattered by the wind upon nearby plants, these spores quickly germinate, spreading the disease with fearful rapidity during the growing season. Later in the summer "black rust" emerges upon the wheat stems as masses of dark-colored winter spores. These germinate the next spring, forming a filament that produces more spores for the wind to waft to the barberry leaves, ready to begin the deadly cycle all over again.

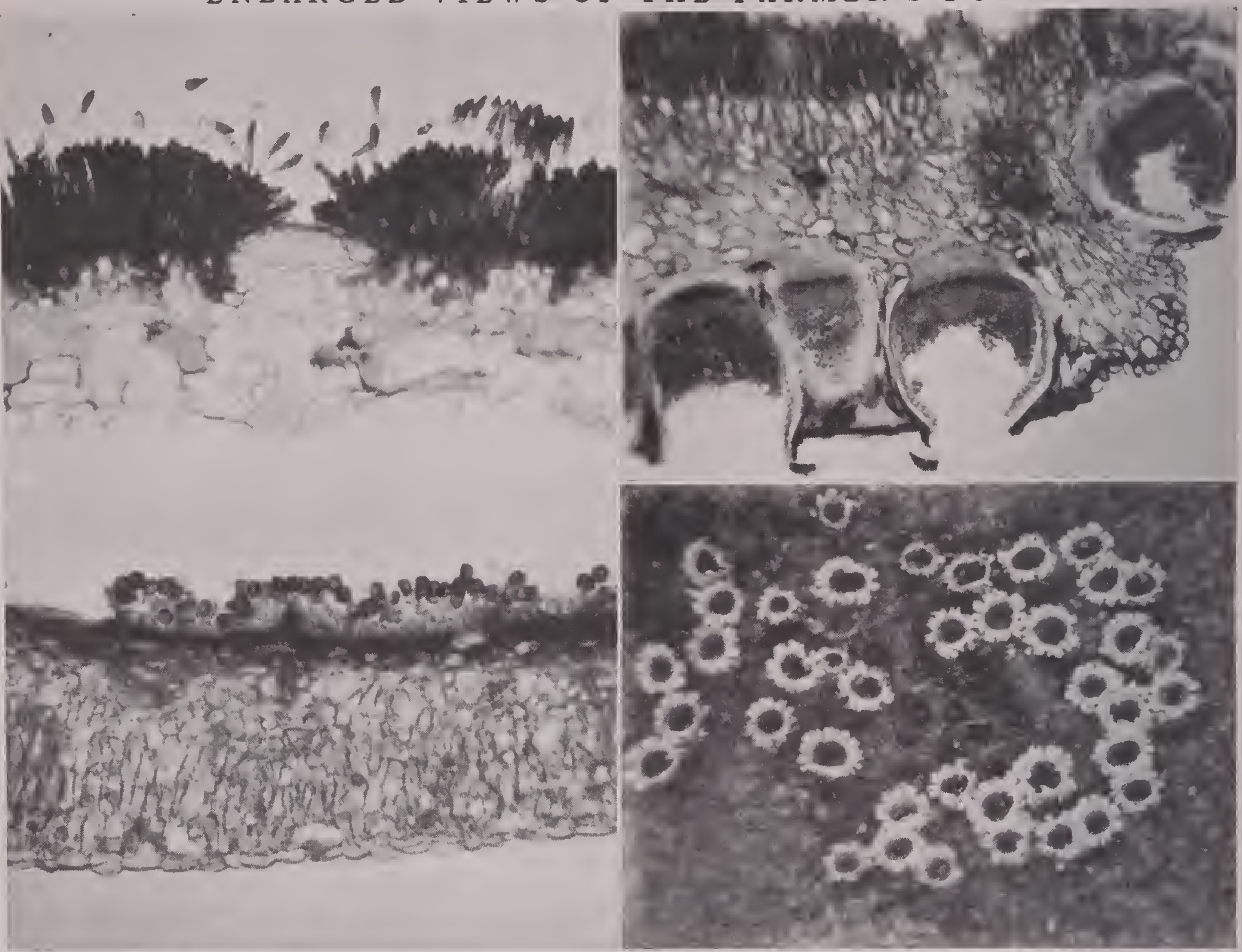
There are many kinds of rusts, the forms attacking the different cereals being entirely distinct. Some have only one host, others two or more. In the case of "white-pine blister rust," the secondary host is the currant or gooseberry bush. In general, rusts divide into three groups: "stem rust" (black rust, most destructive of all), "leaf rust" (red rust), and "yellow-stripe rust," the last discovered in 1915.

FOUR RUSTS AND SMUTS AND THE GRAINS THEY RUIN



Here is the work of rusts and smuts upon wheat (1), barley (2), oats (3), and corn (4). To the left of the shriveled stalks of the first three is a fine healthy head of the same grain with plump well-developed kernels. The smutted ear of corn with its distorted kernels is almost as distressing a sight as a case of human disease.

ENLARGED VIEWS OF THE FARMER'S FOES



In the upper left-hand corner the winter spores of wheat rust are shown breaking from the wheat stalk in spring. To the right is a section of barberry leaf with "cluster cups" full of spores on the under side. In the lower left corner is a section of grass leaf which is furnishing pasture for a fine crop of one-celled summer spores of rust which can germinate on wheat without passing through the barberry stage. What looks like a group of daisies on the right is a daisy leaf on which are growing cluster cups of another species.

The smut fungus has a less complex history. In the case of smut of wheat, oats, and barley, the spores are clinging to the seed when sown. The fungus enters the plantlet soon after it sprouts, grows up with it, steals its food, and usually prevents it from forming seed. Instead, smeary smut masses form, consisting of millions of spores that in the threshing and handling attach themselves to the sound grains, thus endangering the next crop.

Corn smut is different in origin, being caused not by infected seed but by spores which have wintered either on the ground or in the manure used as fertilizer. When spring comes these spores produce others which the wind distributes over the cornfield, to penetrate the young corn plants. Large boil-like growths develop which gradually darken, forming "smut balls."

STILL ANOTHER RUST

The swelling which you see in the central stem of this young pine is due to white pine "blister rust," one of the worst enemies of the forest giants.

Smuts are spoken of as "loose," "covered," and "stinking" smuts. Loose smut changes the spikelet into a sooty mass which the wind blows away, leaving the stalk bare. Heads affected by covered smut remain on the stalk until the harvest. Stinking smut, or "bunt," affects only wheat kernels and is the most destructive of all wheat diseases, sometimes causing the loss of half the crop. The powdery mass inside the smutted grains smells like decaying fish.

For the prevention of grain rusts, experts are pinning their strongest hopes to the development of new varieties of grain able to resist the fungus. Important experiments in breeding and selection are in progress at agricultural stations all over the country. Hard red wheat has been found to offer good resistance. Early-maturing varieties escape the excessive rain and "muggy" weather of late summer, conditions under which the rust plant thrives. Crop rotation helps to cure rust-infected soils. Excess of either nitrogen or moisture favors the infection. For many years "banish the barberry" has been the war-cry in grain-growing districts, and many states have now passed anti-barberry laws. Experiments prove that although the barberry stage is not always indispensable to wheat rust, it increases the distribution of the parasite.

Smuts lend themselves more readily than rusts to the preventive methods of modern agriculture. That is because the smut spores cling to the outside of the seeds and may be killed by disinfecting before sowing. For this purpose three treatments are in common use—by hot water, formaldehyde, and copper sulphate. Bulletins of the Department of Agriculture at Washington, which may be obtained free by writing for them, furnish complete and up-to-date information regarding materials, apparatus, and formulas. Disinfected seed needs, however, to be tested for germination before planting. Because of the peculiar character of corn smut, treating the seed is of no value. The only remedy is to burn the smutted stalks as they are discovered in the field. Fortunately this smut is of relatively small importance economically. Early seeding is strongly advised as a protection against smut as well as rust.

RUTH. In the days when the "Judges" ruled in the land of Israel—so the Bible tells us in the beautiful story of Ruth—a certain man of Bethlehem had gone with his wife Naomi and his two sons to dwell in the land of Moab. There he died and later the two sons, who had married Moabite women, also died. Sad and lonely, Naomi decided to return to her old home. So with her daughters-in-law, Ruth and Orphah, she started for Bethlehem.

Before they had gone very far, Naomi told her companions to return to their homes, for only grief and loneliness were in store for them if they followed her into a strange land. "Go, my daughters," she said, "return each to your mother's house, and may the Lord deal kindly with you as you have dealt with my sons and me." Then she kissed them, with many tears. And Orphah kissed her mother-in-law and went back, but Ruth clung to her and would not go back. "Entreat me not to leave thee," she said, "or to return from following after thee: for whither thou goest, I will go; and where thou lodgest, I will lodge: thy people shall be my people, and thy God my God: where thou diest, will I die, and there will I be buried: the Lord do so to me and more also, if aught but death part thee and me."

So Ruth and Naomi went on together, and they reached Bethlehem in the time of the barley harvest

AND RUTH SAID, "ENTREAT ME NOT TO LEAVE THEE"

On the stony borders of the land of Moab, widowed Naomi pauses, and strong-hearted Ruth makes a momentous choice, saying "Whither thou goest, I will go; whither thou lodgest, I will lodge." It was so that she met Boaz and became the mother of the race of David. This picture by Philip Calderon hangs in the Walker Art Gallery of Liverpool, England.

It was the custom in those days for the poor to go into the fields and pick up, or glean, the grain which the reapers had left behind. Ruth went out to glean, that she and Naomi might have food; and it so happened that she came to the field of a wealthy kinsman of her husband's, named Boaz. He noticed Ruth as she gleaned among the reapers, and he asked after her. And when they told him who she was, and how she had left her native land to come to a strange place, he was deeply moved by her loyalty to Naomi. He spoke kindly to Ruth, telling her to come again to his field. He commanded his young men to treat her with respect and told them to let some of the grain fall on purpose for her.

Ruth returned home very happy that evening and described the great kindness of Boaz. "The man is one of our near kinsmen," said Naomi. So day after day Ruth gleaned in the field of Boaz; and at the end of the harvest he "took Ruth and she was his wife." They were very happy together, and still more happy when a son was born to them. They called him Obed, and in after years Obed became the father of Jesse, the father of David, one of the great kings of Israel. The story may be read in the Book of Ruth in the Old Testament.

RYE. In the northern countries of Europe where wheat does not grow well, rye is the principal breadstuff, making the common "black bread" and "pumpernickel." Usually rye flour contains the whole substance of the grain, and therefore is richer in protein than white wheat flour.

Rye (*Secale cereale*) is a cereal grain closely related to wheat. There are fewer varieties than of any other important grain, and all may be classified as winter or spring types. Rye does not seem to have been cultivated by any of the peoples of antiquity. Its early home was in Europe, probably in the region lying north of the Black Sea. Rye is hardier than wheat, growing on poorer, lighter soils, in mountainous regions, and in cold northern countries, although it does not grow in the extreme north so well as barley. It is sometimes called "the grain of poverty" because of its adaptability to poor soils, but when grown on land good enough for wheat it will grow thick, stout, and seven feet tall. The world's production of rye is less than half that of wheat. Russia, Germany, and the Scandinavian countries are the chief producers. In the United States it is of minor importance compared with wheat or oats; only about one bushel of rye is grown to 20 bushels of wheat.

The rye plant is too strong and wiry to make good forage for cattle, though it is grown in the south of England for this purpose. Another objection to it as a forage crop is that it is subject to the attack of a highly poisonous fungus. The fungus (*Claviceps purpurea*) grows in place of the grains, and forms horny masses called "ergot." Ground rye and rye bran are used as stock feed. Rye straw is longer and more uniform in size than that of other grains, and is used in the manufacture of paper, pasteboard, and hats. It is also used for thatching roofs in parts of Europe, and for stuffing horse collars.

S

SABBATH. It has been said that the Sabbath is "a festival not of one city or one country, but of all the earth." A weekly day of rest has been found among almost all nations, including the ancient Egyptians, Chinese, Hindus, Persians, Greeks, and Romans.

It has been said that the Hebrews derived their Sabbath from the Babylonians, but as observed by the Hebrews it acquired a new significance. It was a day of rest (the Hebrew *shabath* means "to rest"), but it was also a holy day, a memorial of the completion of creation on the Seventh Day and of the deliverance of the Israelites from Egyptian bondage. The Hebrew Sabbath is the seventh day of the week (our Saturday) and it lasts from sunset on Friday to sunset on Saturday. During this time all labor must cease; according to the fourth commandment it was forbidden also to cause servants or animals to labor. Orthodox Jews still observe their Sabbath strictly.

Among Christians, the *first* day of the week, as the Lord's Day, the day of Christ's resurrection, early came to be regarded as more holy than the Hebrew Sabbath, and so Sunday came to supersede Saturday as a day of rest as well as a day of worship. The church transferred many features of the Jewish Sabbath to Sunday and designated that day as the Sabbath. However, there are some Christian sects which today observe the seventh day as their Sabbath. Mohammedans keep Friday as the day for special religious services, but they are not required to rest from their labors except during the time of the midday prayer. (*See* Day; Week.)

SACRAMENTO, CALIF. Camellia-wreathed Sacramento, with its gold-domed statehouse, is the political capital of the state and the "geographical pivot" and commercial capital of the great twin valleys—the Sacramento to the north and the San Joaquin to the south. It is one of the leading manufacturing cities of California, shipping immense quantities of flour and grist-mill and rice-mill products to China, Japan, and Australia.

The present site of Sacramento was included in New Helvetia, the 11 square leagues of land which Capt. John A. Sutter secured from the Mexican government in 1839. Sutter's Fort, the nucleus of the first California settlement of gold-seekers ten years later, is within the city limits; it is now restored and used as a museum. It was in January 1848 that gold was discovered in Sutter's millrace, some miles up the valley; and soon Sacramento was the roaring metropolis of the mining camps so well described by Bret Harte. In those days clipper ships from around the Horn used to sail into San Francisco Bay and up the Sacramento River to Sacramento; and the splendor and luxury of the floating palaces which plied between San Francisco and Sacramento in the "glorious '60's and '70's" is a dazzling memory. The greedy gold-seekers demoralized navigation up the Sacramento when they forsook the shovel for the speedier hydraulic monitor, flinging whole mountainsides into the river, reducing the channel from 13 to 6 feet in depth, and making the Sacramento, in proportion to the territory it drains, the wildest, most flood-ridden river in the United States.

Sacramento has survived the floods, the crippling of its water transportation, and the passing of the mines; for the great days of wheat succeeded those of gold, and the Central Pacific Railroad reached the city by 1868. For a brief time the valley of the "Nile of the West" seemed destined to be, with the San Joaquin, the nation's granary. But the patient soil, never irrigated, never fertilized, never rested, at last rebelled; yields dropped from 45 bushels an acre to 13 and 8, and the reign of wheat was over. This checkered past explains the slow growth of a city of such tremendous potentialities.

With the breaking up of the vast grain ranches and the introduction of irrigation, a new era has dawned. Within a 45-mile radius around the city are grown 75 per cent of the deciduous fruits of the state; and from 20,000 to 25,000 carloads—fresh, dried, and canned—are annually shipped out of it. Rice is the third most important crop, fruits being first and the hay and grain crops second. Olives, nuts, grapes, oranges, hops, choice vegetables for the Eastern markets, butter, and fish from the Sacramento River are among the exports. Millions of dollars have been spent to restore the navigability of the Sacramento River, to control the floods, and to reclaim the flooded lands. In addition to its transcontinental railroads, therefore, Sacramento now has water transportation over the fourth river in the United States for tonnage carried, and its prosperous future is assured. Population, about 66,000.

SAGEBRUSH. Over immense areas of the arid plains of western United States, clumps of gray-green sagebrush, dotted here and there over the sand, form the principal vegetation. Of the several varieties, the best known and most abundant is the common or bitter sage. Usually it grows as a dwarfed shrub, although sometimes it attains almost treelike proportions, with the twisted and knotty trunk measuring nearly a foot through near the ground.

Some varieties, principally the salt sages, so called because they grow in waste land containing so much alkali that little other vegetation can exist, are important winter forage for sheep and are occasionally eaten by cattle when other food is very scarce. Black sage, which sometimes grows to a height of ten feet or more, is used as fuel by the settlers in some of the more isolated regions. Nevada has been nicknamed "The Sagebrush State" on account of the great amount of sagebrush growing there.

The common or bitter sage is *Artemisia tridentata.* Tarragon, a popular flavoring for vinegar, is a European variety of Artemisia, *Artemisia dracunculus.* (For the flavoring herb called sage, *see* Mint.)

SAGO. The sago of our puddings has traveled far to take its place as the basis of a nutritious dessert. It is obtained from the starchy soft inner portion of several East Indian palms, Borneo supplying the greater part of the sago of commerce.

The sago palms grow to a height of 30 feet or more in low marshy soils. Their strong trunks have a hard outer layer, nearly two inches thick, and inside this is the spongy portion which contains the starch product. The trees flower only once, when they are about 15 years old, and die after maturing their seed. To make sago they are cut down just before they are ready to flower, for the production of the fruit exhausts the starch center. The pith is chopped and grated to a powder and mixed with water to extract the starch particles. This is kneaded in water in a sieve or cloth, the water carrying off the starch and leaving the woody fiber behind. The starch is then allowed to settle and is dried. When pressed through a sieve it forms fine pearly grains which are the "pearl sago" of commerce. It is eaten in the form of cakes or soup by the natives, to whom it is an important article of everyday diet. Sago is rich in carbohydrates (starch and sugar) and is easily digested. A single tree often yields 700 pounds of pith.

The spineless sago-palm *Metroxylon laeve* and the prickly sago palm *Metroxylon rumphii* furnish the bulk of the sago exported to Europe and America. South America has two sago-yielding palms.

KING SAHARA *and His* DAUGHTER DESERTS

The Burning Wastes of the Great African Desert and Its Continuations across Central Asia—Why Rain is Lacking and How the Vast Sand Dunes Have Been Made—Oases and Caravans

SAHA'RA. If you will look at the map of the world and sweep your finger from the westernmost coast of Africa in a diagonal line to far-away Manchuria in eastern Asia, you will have traced roughly the backbone of the great desert belt of the Old World. For a stretch of 10,000 miles, interrupted only by a few great streams, one desolate region succeeds another. First comes the Great Sahara Desert, which, beyond the narrow valley of the Nile to the east, becomes the Nubian desert. Then the arid waste leaps the Red Sea and merges into the Arabian and Syrian deserts. Waste lands then continue in patches through Persia, branching southward to the great desert of Sind in India, and northward over the barren highlands of central Asia to the immense sandy stretches of the Gobi desert in Mongolia. Altogether it is a vast desert chain, stretching almost halfway around the world, with little or no rainfall, so that plant life barely subsists.

Of all these deserts, and of all other deserts in the world, the Great Sahara is king. With a length of 3,200 miles and an extreme breadth of 1,400, making an area of about 3,500,000 square miles, the Sahara is nearly equal in size to all of Europe. From the Atlas Mountains on the north to the Sudan on the south and from the Igidi region of Morocco to the Nile valley, there is not a single river. Occasionally the "wadies," or dried beds of ancient streams, will carry torrents of water after one of the rare cloudbursts, but this is quickly swallowed up in the thirsty earth, or goes to feed the infrequent springs and wells which form the center of scattered oases.

Far from being merely a great rolling waste of sand, as is often believed, the Sahara contains many lofty and rocky ranges and plateaus in the interior, some with peaks from 8,000 to 9,000 feet in height, crowned with snow in the winter. The lack of rain in the Sahara is due to the great land mass of Africa, which causes an outflow of air during the winter, thus driving away ocean moisture. In the summer, when there is an inflow of winds, the ground is so intensely heated that the winds are dried up before they have reached far inland. In the eastern part are several spots below sea-level, usually containing oases, which show the natural fertility of most of this desert soil wherever moisture is sufficient. The chief habitable areas are Tuat, south of Algeria, and Ghat and Kufra, to the south of Tripoli. Greatest of the oases is El Erg, just south of the Atlas Mountains, where enough water is found to irrigate between eight and ten million date palms.

The great shifting sand dunes of the Sahara are believed to have been created by the violent and sudden changes of temperature. Under the boiling noonday sun the ground sometimes gets as hot as 200° F., yet at night the temperature may fall below

THE VAST WAVES IN THE SEA OF SAND

Only the tracks of small wild creatures break the rippling surface of the wind-sculptured sand waves stretching away to the far horizon. Here is the home of the wandering Arab and Tuareg with his camels.

freezing. This causes the natural desert rock to crumble, forming sand which is then swept up by the wind and whipped against other rocks, eating them away in turn. Portions of the Sahara undoubtedly formed the ocean bed at one time, for fossil remains of salt-water creatures have been found.

The wild animals found in the desert today are jackals, foxes, hares, a few gazelles and antelopes, and a few species of birds, including the ostrich, the vulture, and the raven. The central desert is inhabited by the wild robber tribes of Tuaregs; the east by Bedouins and Tibbu, the latter of mixed negro stock; and the west by Berbers.

Outside of a Spanish colony (Rio de Oro) on the west coast, and the Fezzan, which is attached to the Italian colony of Tripoli (Libya), the greater part of the Sahara west of the Nile valley is French.

The principal cities in the Sahara, or so close to its fringes that they serve as caravan centers, are Ghadames, Murzuk, Kufra, Ghat, and Insala, in the north; and Kuka on Lake Chad; and the famous Timbuktu on the Niger River in the south.

The French are pushing railway lines into the desert from the north and are constantly boring new artesian wells to bring prosperity to the scattered tribes they have now in most part subdued. Airplanes carry mail to distant military posts. During the World War a German zeppelin passed over it and back in a belated attempt to carry munitions to Germany's African colonies. With the advance of civilization it is hoped that some day vast tracts of the Saharan wastes may be reclaimed.

Over the Burning Sands with a Caravan

IT is three o'clock in the morning on the edge of the great Sahara desert. The stars are still shining through the date palms that sway in the light breezes from the south. Scattered over the ground are black humped shadows of sleeping camels. Smaller dark blots are grazing donkeys and goats, and here and there are the white, outstretched figures of Arabs. One of the figures stirs and rises, gazes a moment at the sky, and sends out a long weird call.

The effect is like magic. On all sides noisy life springs up from silent sands. Camels lift their long necks with complaining groans, donkeys bray, goats bleat, dogs bark, men shout to one another as they bustle about in the growing dawn. Small fires blaze up. The Arabs are at their prayers or rolling up their mats, while black servants prepare the simple breakfast and load the complaining pack animals.

It is the hour for the big caravan to start on its thousand-mile journey southward across the desert. By the time the orange-gold of the morning sunlight touches the tip of the highest date palm, the long line of men and beasts is on its way. Slowly it crawls like a huge loose-jointed snake over the endless wilderness of black rock and yellow sand.

At the head of the column rides the caravan chief on a prancing horse. A long rifle is slung over his back and his face and entire figure are muffled in flowing white. His word is caravan law. Behind him in narrow file pace hundreds of heavy-footed camels, balancing on their backs bales and boxes containing cotton cloth, silk, sugar, drugs, tea, small articles of metal, together with beads and scores of other trade articles. By their side walk the owners or drivers, leading donkeys who carry food and water for the long march. The goats, which furnish milk or are to be killed for meat, straggle along at the rear, keeping barely ahead of the snapping dogs that aid in herding them.

A FLEET OF "DESERT SHIPS" UNDER WAY

A caravan may include as many as 1,000 camels. Without these strange beasts, so marvelously adapted to life in sandy regions, even the Bedouin or the Tuareg could scarcely have achieved the conquest of the Sahara.

The Silent March under the Burning Sun

It has taken perhaps a year to gather the men and beasts and merchandise for this great caravan. Arab and Jewish merchants in the coast towns of North Africa—Tripoli, Tunis, Algiers—have invested their fortunes in those swaying camel packs. They will wait anxiously another year, perhaps, before these "desert ships," having cruised to the southern shores of the great ocean of sand, return with precious loads of ivory and gold, skins, and ostrich feathers, gathered by barter with the natives in the heart of Africa.

Meanwhile the caravan moves on, perhaps two miles an hour, treading the old trail worn deep by the pads of camels and the naked feet of men in the course of centuries. The sun rises higher, and the heat strikes down and flares up again from the sand in shimmering waves. The cries of the animals are hushed. The only sound is the creaking of leather in the packs, and the endless *pad, pad, pad—swish, swish, swish*—of the hundreds of heavy feet dragging across the soft shifting sands. To break the silence that leads to desert madness, and to forget that fierce burning light that bites at men's eyes and makes them blind, a plodding Arab starts a weird caravan song, timed to the monotonous beat of the camel's stride. The chant spreads up and down the line, and the empty hills echo the brave deeds of ancient heroes in love and war.

From ten in the morning until three in the afternoon the caravan rests to let the worst heat of the day pass by. If they have reached an oasis—where there is water and palms and green grass—men and animals may stretch themselves in the shade. If the stop is in the open desert, they lie or crouch on the sand, the men throwing their cloaks over their heads.

But the heat, the constant fear of a dried-up well that may leave men and animals to die of thirst, the sudden sandstorms that sweep across their path—these are not the only dangers that beset the caravan. For in the heart of the great desert dwell a strange race of men, the masked Tuaregs, who prey upon the caravan trade and, like pirates of the sands, levy tribute upon all who pass their way.

Perhaps while the march is on, the caravan leader will see black specks on the horizon moving rapidly forward. A halt is called. Soon two or three Tuaregs sweep up on their racing camels. They bargain with the leader. For a certain sum in money or merchandise they will protect the caravan; otherwise—

Stubborn caravan leaders have sometimes refused to deal with the Tuaregs. Some of those caravans were never heard of again; or perhaps a few survivors, dying of thirst, have staggered into an oasis to tell of a sudden ambush, the swoop of hundreds of masked men, shots, knives flashing, camels stampeded over the desert with their loads, and everything lost.

SAINT AUGUSTINE, FLA. Strange and exotic indeed seems this ancient town. Narrow but well-paved brick and asphalt streets, where in times past wheeled vehicles were not allowed; massive fortifications and ruins dating back to the Spaniards' times; old white-walled houses in the Spanish style, built of the native coquina (a stone like pudding-stone, but containing shells instead of pebbles); magnificent hotels in the Spanish Renaissance and the Moorish styles of architecture, but with more than Spanish or Moorish splendor and luxury—these, in a setting of semitropical foliage, today distinguish the oldest permanent European settlement in the United States.

In 1565, Pedro Menendez de Aviles, hastening to snatch Florida from the grasp of French Huguenot settlers (*see* Coligny, Gaspard de) and secure it for his master, King Philip II of Spain, founded St. Augustine on the peninsula between the Matanzas and San Sebastian rivers, on the Florida east coast. This was 42 years before Capt. John Smith and his companions landed at Jamestown, the first permanent English settlement. Yet the tardy English were to be the bane of this remote Spanish outpost. Sir Francis Drake burned it in 1586; Capt. John Davis sacked and again burned it in 1665; Georgia and South Carolina harried and harassed it, and were in turn harried and harassed. When Florida was re-ceded to Spain in 1783, after 20 years of English possession, nearly all the English inhabitants of the city emigrated to the West Indies or to the United States.

The most important historic relics in St. Augustine are the old Spanish fort San Marco (begun about 1656; finished a century later), now called Fort Marion; the old city gates and fragments of the city wall, built as defense against the Indians; and the Plaza de la Constitution, where during the Revolution loyalists burned the effigies of John Hancock and Samuel Adams. St. George Street, the main thoroughfare, is only 17 feet wide. Probably more people are drawn to Saint Augustine by its winter climate and its splendid hotels than by its historic monuments. About 75,000 annually visit the little city, which has a permanent population of about 6,500, not including the suburbs, which have about 3,000 more.

SAINT-GAU'DENS, Augustus (1848–1907). As a "reg'ler boy" in the Bowery district of New York City in the early days of the Civil War, this immigrant son of French and Irish parents played tricks on shopkeepers and dodged policemen with the rest of his "gang." But he did more than this, for when 13 years old he was apprenticed to a cameo cutter, and besides, he attended the art school of Cooper Union and classes at the Academy of Design. He loved to sketch and model in clay, and when he was 19 years old, with only $100 of "saved-up" money, Saint-Gaudens went to Europe to study sculpture with the great artists of Paris and Rome.

He had a hard struggle there, for $100 didn't go very far even then, but he was able to pay his way by working at his trade of cameo cutting. Finally, after six years of study and practice in the studios of Europe, his work attracted the attention of a wealthy American who was in Rome. He helped Saint-Gaudens to get orders for work so that he was able to return to the United States and open a studio of his own in New York City—the first American sculptor who had had the benefit of a complete training in the greatest centers of European art.

Although Saint-Gaudens was born in Dublin, the home of his Irish mother, the family had removed to New York when he was only six months old. He was a real American and his great bronze statues reflect the spirit of the nation. His 'Puritan' (Deacon Chapin) at Springfield, Mass., represents the stern strength with which the New England forefathers endured and conquered. His 'Lincoln' in one of the Chicago parks is usually considered to be the finest portrait statue in America. Saint-Gaudens' greatest masterpiece, however, is on Boston Common—the memorial to Robert Gould Shaw, commander of the first negro regiment which was raised by the North for service in the Civil War.

New York possesses Saint-Gaudens' 'Admiral Farragut', in every line of whose garments and firmly braced figure we feel the ocean's gales; and his 'General Sherman', a mounted warrior preceded by the figure of Victory. Also notable is his equestrian statue of General Logan in Grant Park, Chicago, which is the embodiment of martial energy. Of another sort than these war memorials but of an art in which he was America's leader, is Saint-Gaudens' low relief plaque of his friend Robert Louis Stevenson, commemorating in bronze the charm of personality and frail health of this universally beloved author.

SAINT JOHN, New Brunswick. In winter when ice has closed all the other important seaports of Canada except those of the Maritime Provinces, the great harbor of St. John is always open. It lies at the mouth of the St. John River on the Bay of Fundy, whose immense tides, about 25 feet high at this point, coöperating with the waters of the river, prevent the formation of ice. This advantage, together with the short rail haul from the interior, serves to strengthen the position of St. John as the chief winter port of Canada. It is the Atlantic terminus of the Canadian Pacific Railway and is also one of the termini of the Canadian National Transcontinental Railways, which bring the grain and other products of upper and western Canada for winter shipment.

One of its attractions is the natural wonder of the reversing falls in the St. John River. When the tide is out the falls flow toward the sea; at half tide or slack water they are open to navigation both ways; at high water or full tide the current flows inward, hence its title of "Reversing Falls."

Grain elevators, a large sugar refinery, cotton mills, iron and brass foundries, flour and rolling mills, saw and wood-pulp mills, woodworking factories, and other industrial establishments make St. John one of the chief manufacturing centers of the Maritime Provinces. It was the first city in Canada to adopt the commission form of government. The name of the city and river comes from the circumstance that the explorer Champlain landed here in 1604 on the feast day of St. John the Baptist. It has been an important city since 1783, when it received an immigration of 10,000 United Empire Loyalists from the American colonies. Population, about 64,000.

SAINT LAWRENCE RIVER. Although its length is only about one-fifth that of the Mississippi, the St. Lawrence River is perhaps the most important water route for commerce in the New World. The Great Lakes find in it their natural outlet to the Atlantic Ocean, and on its waters great ocean-going steamers penetrate 1,000 miles into the heart of the country—to the city of Montreal, the great distributing center for western Canada. Smaller vessels, avoiding the rapids above Montreal by means of locks and canals, go clear to Duluth at the farthest end of Lake Superior, or to Chicago at the southern end of Lake Michigan—distant 2,343 miles and 2,272 miles respectively from the Atlantic Ocean.

The St. Lawrence emerges from the foot of Lake Ontario and flows in a northeasterly direction until it discharges its waters into the Gulf of St. Lawrence—

> Then out to the sea with a stately sweep
> It mingles its tide with the mighty deep,
> As it has for a thousand years—

the outlet to the Atlantic being either south of Newfoundland past Cape Ray and Cape Breton, or north of Newfoundland through the Strait of Belle Isle. The latter course is the shortest route to England but not the one usually followed by vessels on account of the greater danger from fog and ice.

About 400 miles upstream from the island of Anticosti, which stands where the river's estuary widens into the gulf, is the quaint old French Canadian city of Quebec, built partly on a high bluff above the river. From Quebec to Montreal, 160 miles farther upstream, the channel has been improved to permit large vessels to reach the latter city. For a distance of 30 miles above Montreal there is a series of rapids which proved a formidable barrier to early exploration. The first of these, the Lachine ("China") Rapids, was so named by the French explorer Cartier because he believed the "great sea" beyond, as described to him by the Indians, was the Pacific Ocean (and not the Great Lakes), and that when once past the rapids he should find a new water route to China. Several canals with locks have been built around these rapids, so that vessels of 14-foot draught may now traverse the whole waterway. About 100 miles above the rapids the St. Lawrence widens into a narrow lake studded with the Thousand Islands, world-famed for their scenic beauty. A veritable fairyland, this lovely island group, now dotted with elegant villas and summer hotels, was once a paradise for the red man, who called the region *Manatoana* (The Garden of the Great Spirit). On the Canadian shore of Lake Ontario, at the point where the river leaves the lake, 170 miles southwest of Montreal, lies Kingston, an important grain-transferring port. Throughout its length, from Lake Ontario to the gulf, the St. Lawrence flows past fertile plains and low hills merging into bluffs, with here and there an isolated peak of the Laurentians or the Green Mountains to break the skyline and add to the beauty of the picture.

CANADA'S GREAT HIGHWAY TO THE SEA

As far as Quebec the St. Lawrence is virtually an arm of the sea. Quebec harbor, past which this fleet of cruisers is steaming, is wide enough and deep enough to hold the largest ships. On the farther side of the river you see Cape Diamond, crowned by Quebec citadel; at the foot of the cliffs is the lower town.

The importance to Canada of the St. Lawrence River cannot be overestimated. The shortest freight route from the Great Lakes to Europe, it is the natural highway for shipping grain from the fertile regions of Canada and the northwestern United States. It furnishes also a means for shipping large quantities of lumber and paper pulp—manufactured at small mills along the river and its tributaries—directly overseas from the place of production. As a commercial route the river has, however, two drawbacks. Steamers drawing over 14 feet of water cannot go through the canals above Montreal, so the larger steamers from the Great Lakes must transfer their cargoes at Kingston and Prescott to smaller ones, to be again transferred at Montreal, perhaps, to ocean-going vessels. In time this difficulty will doubtless be overcome through the widening and deepening of the canals and the construction of larger locks. Another inconvenience is caused by the close of navigation from the head of Lake Superior to Quebec, through the freezing up of the harbors, rivers, and canals, for five months of the year.

The St. Lawrence was discovered and named by Jacques Cartier, who was commissioned by the king of France to explore the American coast. In 1534 he entered the Strait of Belle Isle and encircled the gulf, but it was not until a second voyage two years later that he discovered the entrance to the river. He was the pathfinder who penetrated as far as what is now Montreal, but he established no settlements.

This was left for Champlain, who in 1608 planted a colony on the site of Quebec, and between that date and 1616 explored the whole river system as far west as Lake Huron, taking possession of the country in the name of the king of France. By the treaty of Paris in 1763, however, practically the whole of the French claims to America east of the Mississippi were ceded to Great Britain, under whose rule the Canadian portion of this vast region including the entire length of the river, still remains.

SAINT LOUIS, Mo. Situated a few miles below the junction of the Mississippi with the mighty Missouri, St. Louis spreads over 20 miles of the curving west bank of the Mississippi and extends back nearly ten miles from its once busy levee on the river front. St. Louis is a great city, a very great city, in wealth, industry, and resources. The chief receiving point for the vast and rich territory to the southwest, and the chief market for the central area of the rich Mississippi valley, it has long held its position as one of the leading cities of the United States. It is today a metropolitan center with a population of about 775,000. The tributary district of East St. Louis, across the river in Illinois, and the suburbs which its old charter prevents it from annexing, add about 450,000 more.

Its interests are as varied as they are important. It is the largest manufacturing center for tobacco in the world, holds first place in the output of American-made chemicals, and is the principal horse and mule market in the United States. The great quantities of coffee received every year from Brazil make it the largest inland coffee market. When the Great War closed the fur markets of England and Germany, St. Louis, which had been an important fur center, sprang into place as the largest raw fur market in the world, receiving furs from every state in the Union, from every province in Canada, and from Alaska.

Shoes for a Nation

St. Louis has other greatly diversified industries. Its annual output of shoes is sufficient to provide every fourth person in the United States with a pair. It is one of the greatest lumber markets of the world, and there are immense woodenware and furniture factories. The decreasing production of ore in Missouri caused a decline of the once important pig-iron industry, but St. Louis developed her manufactures of finished iron and steel goods, and now turns out quantities of structural iron, castings, machine-shop and foundry products, boilers, stoves, wire goods, cutlery, tools, and agricultural implements. Missouri is a great producer of lead and zinc, so the manufactures of lead and zinc products, plumbers' and steam-fitters' supplies, paint and white lead have become distinctive St. Louis industries. Other important products are railroad cars, vehicles, motors, electrical goods, enameled ware, drugs, soap, men's and women's clothing, and food preparations.

The river and the railroads in turn have given St. Louis her commercial importance. When the Mississippi River was the great highway of traffic, St. Louis had its first great period of growth. With the cessation of the river traffic, St. Louis marked time for awhile, then caught the swifter cadence of the railroad. The city's terminal facilities center in Mill Creek Valley, which traverses the city from east to west from the river to the city limits.

Several great bridges span the mighty Mississippi and connect the city with Illinois. The newest of these, the Municipal Free Bridge, is the largest double-decked bridge in existence. Eads Bridge, completed in 1874, was the first bridge to span the lordly Mississippi; it carries both wagon ways and railroad tracks, and is 55 feet above high water so as not to interfere with river traffic. Built entirely of steel above its piers, its long spans arching high over the swiftly flowing water, it gives an appearance at once of graceful beauty and invincible strength. There are also passenger and freight ferries. The port of St. Louis is the largest river port in the United States. The city has a municipal river dock and the government has appropriated several million dollars for barge lines to operate between St. Louis and St. Paul, and St. Louis and New Orleans.

The St. Louis of History

St. Louis originally consisted of three streets back from the river. This old section later became the business district, and now for the most part is given over to commission merchants and great silent warehouses. Here and there a façade of rare distinction or a glimpse through cobwebbed windows of a wonderful stair, and the very sturdy and substantial old cathedral of gray granite, with its exotic French inscriptions, speak of this section's former glory. The old court house is near by, interesting as a dignified structure, and as the scene of the whipping post and of the slave sales held in former days on its steps. The old French market and the municipal markets are also places of interest.

St. Louis has a solid limestone foundation. It is built on a succession of slight ridges and depressions to the west, each ridge a little higher than the last, rising to meet the plateau of the Ozarks. The first ridge is at Broadway, the fifth street back from the river. Railway tunnels running under the retail district take the traffic that crosses the river bridges to the Union Station.

The streets of downtown St. Louis are narrow, a legacy of other years. Wide highways, however, span the city from east to west, sometimes curving from the river to the river, and these great arteries of traffic make the entire city easily accessible.

The Beautiful Park System

Parks are scattered in all sections of the city. Forest Park, the largest of these, is located just beyond the beautiful residence districts of the new St. Louis, and is a rolling strip of virgin forest. This park was the site of the Louisiana Purchase Exposition of 1904. The building now occupied by the St. Louis Art Museum was the central hall of a group of buildings devoted to art at that time. Another building saved from the Exposition is the superb red granite entrance hall of Washington University, one of a group of the most appropriate collegiate buildings in the New World. In the southwestern part of the city is the Missouri Botanical Garden, popularly known from the donor as Shaw's Garden; this contains one of the fine botanical collections of the world.

The Quarries and the Builders

Nearly all St. Louis houses are constructed of brick and stone, and even today it is not necessary to go beyond the city limits for most of the building materials. The local quarries are still worked and brick is manufactured in enormous quantities, as well as lime, cement, sewer pipe, and terra cotta.

Jefferson Barracks at the southern end of St. Louis is one of the largest military reservations in the United States, and one of the four principal recruiting posts. St. Louis has several libraries, two large universities — St. Louis University (Catholic) and Washington University—a number of colleges, medical schools, and numerous convents and seminaries. The yearly Veiled Prophet's Pageant is modeled on the Mardi Gras of New Orleans.

The history of St. Louis begins with its founding, in 1764, as a fur trading post in the northern part of the Louisiana country. The city became part of the United States as a portion of the Louisiana Purchase. For 100 years, from 1764 to 1864, the business district of St. Louis remained where it was located on Pierre Laclede's map. With the coming of the railroads, the business district slipped back from the river.

St. Louis has passed through many crises. When the Civil War destroyed the commerce between North and South, and the development of the railroads opened up the great east and west traffic routes, St. Louis suffered very heavily. Fire, floods, and tornadoes have attacked the city, but it has survived even such a signal disaster as the tornado of 20 minutes' duration in 1896 which destroyed many lives and more than $10,000,000 worth of property.

SAINT-MIHIEL (*săṅ-mē-yĕl′*), FRANCE. After the United States troops in the World War of 1914–18 had proved their valor and coolness while fighting at the side of the French and British at Cantigny, Château-Thierry, Belleau Wood, the Marne River, the Vesle, and other memorable battle-grounds, General Pershing requested the privilege of launching against the German lines an American attack, under the exclusive direction of American officers.

Marshal Foch, commander-in-chief of all the Allied forces, gladly accepted the offer and, pointing to a map of the battle front, put his finger on a spot where the enemy trenches cut a deep wedge into the French lines. "The Americans may make that line straight," he said.

That spot was known as the "Saint-Mihiel salient," because at its extreme point stood the little town of Saint-Mihiel, 20 miles south of Verdun on the Meuse River. It had been captured on Sept. 12, 1914, by the armies of the German Crown Prince in his effort to surround Verdun, and the wedge made at that time had remained ever since a thorn in the French side. It cut across three important railway lines, and was a constant menace to the Verdun defenses. Yet so strongly had the Germans fortified themselves on the rugged heavily wooded heights of the Meuse that it had resisted all efforts at recapture.

On Aug. 10, 1918, the First American Army was formed under the personal command of General Pershing. Ten days later it began concentrating secretly in the Saint-Mihiel sector. On the night of September 11, all was in readiness. About 500,000 men were in line, 70,000 of whom were French colonial troops under American command. The American shortage in artillery was met by French guns. An air force made up of American, British, and French planes was gathered together, constituting the largest aviation group assembled up to that time for a single battle.

At dawn on September 12, exactly four years to the day after the German capture of Saint-Mihiel, the attack was launched. Hours of violent shell fire had prepared the way for the infantry. With magnificent spirit the Americans drove through the German flanks from the south and the west, pinching the German center at the town of Saint-Mihiel like a nut in a nutcracker. So rapid was the advance that the ground which the Americans had been given four days to capture was all taken by the evening of the second day, besides 16,000 prisoners, 443 guns, and large stores of food and ammunition.

This victory at Saint-Mihiel paved the way for the greater victory which the Americans were to win in the Argonne region a few weeks later—a victory which was to be one of the chief factors in forcing Germany's surrender (*see* Argonne Forest).

The following divisions of the United States Army took part in the Saint-Mihiel battle: 1st, 2d, 4th, 5th. 19th, 26th, 42d, 82d, 89th. The corps commanders were Major-Gen. Hunter Liggett, Major-Gen. Joseph T. Dickman, Major-Gen. George H. Cameron, and Major-Gen. E. J. Blondlat.

SAINT-NAZAIRE (*săṅ-nä-zâr′*), FRANCE. "So this is France!" These words often passed from lip to lip among the American troops as the troopships drew up to the docks in the French port of Saint-Nazaire in 1917 and 1918, during the World War. There was often a note of disappointment in the exclamation, for Saint-Nazaire is not prepossessing, and, like seaports in many parts of the world, is not really typical of the country at large.

It is a small town on the right bank of the Loire River, where it flows into the sea. Except for the boulevard along the harbor, the town is ugly and inclined to be dirty. It is of recent growth and its chief interest centers in the great shipyards and steel works.

The great event in the career of Saint-Nazaire was the arrival of the American army during the World

War. For, with Brest to the north and Bordeaux to the south, Saint-Nazaire was placed by the French government entirely in the hands of the Americans, who had full control of the port, with power to remodel the quays or harbor as might be necessary. So complete was this control that the French themselves were obliged to ask permission to enter their own port. The work done by American engineers in improving the harbor facilities has been of permanent advantage. Population, about 38,000.

SAINT PAUL, MINN. Situated at the head of navigation on the Mississippi River, and forming a hub for the railroad systems of the Northwest, Minnesota's capital has become the great jobbing center for that section of the country, with some of the largest wholesale houses in the United States, and with an extensive and constantly growing meat-packing business. It is also the army headquarters for the entire Northwest.

St. Paul is built upon a series of limestone bluffs on both sides of the river, but principally on the eastern side. Its western limits touch the limits of Minneapolis—the twin city with which it has grown up so rapidly in the past 25 years; and the two cities are connected by several interurban lines and by boulevards on both sides of the river which link their beautiful parks and lakes. Adjoining St. Paul on the southwest, at the junction of the Minnesota and Mississippi rivers, is Fort Snelling, the army headquarters, with its old round stone fort built in 1819. Crowning a hill, from which it can be seen for many miles, is the state capitol, built of Minnesota granite and white Georgia marble; and on another hill not far distant is the magnificent Roman Catholic cathedral, with its huge copper dome, built in 1917. The imposing public library is a memorial to James J. Hill, the railway magnate of the Northwest. Near the state fair grounds is located the School of Agriculture and the experimental farm of the University of Minnesota. St. Paul is also the seat of Macalester College (Presbyterian), Hamline University (Methodist), St. Thomas College (Roman Catholic), and Concordia College (Lutheran).

Not only are its markets and wholesale houses full to overflowing with live stock, grain and other farm products, groceries, drugs, and many commodities, but its busy factories turn out quantities of fur garments, foundry and machine-shop products, dairy products—especially butter—flour, and boots and shoes. The great stockyards and slaughtering and packing houses of South St. Paul are ever growing and promise to take their place among the country's greatest establishments in that line.

In the early days of western settlement steamboats carried freight and passengers up the Mississippi River to the head of navigation, and where these goods and settlers landed, a few log huts and a landing were built in 1838, forming the nucleus of the thriving city of today. In 1841 Father Lucien Gaultier erected a log mission chapel, which he named St. Paul's and from this came the name St. Paul's Landing, which was later changed to St. Paul. The city is governed by a commission according to a charter adopted in 1913. Population, about 235,000.

SAINT-QUENTIN (*săṅ-kăṅ-tăṅ′*), **FRANCE.** Before the World War of 1914–18, Saint-Quentin was a flourishing little town of France, on the Somme River, 95 miles northeast of Paris. After the war it was little more than a heap of ruins, above which stood the gutted walls of one of the most beautiful cathedrals of France. The cathedral was blown up by dynamite by the Germans and the town was destroyed partly by shell fire during the battle of the Somme, and partly by dynamite. For Saint-Quentin was captured by the Germans in 1914, and it stood just behind the fortifications of the Hindenburg line, opposite the British army, during the constant fighting of 1917–18. So complete was its destruction that the French could consider, although they did not adopt, the project of rebuilding it completely at a more favorably located spot on the river, leaving its ruins to disintegrate.

Saint-Quentin was an industrial town in a sheep-grazing country, whose principal industries were cloth mills and embroidery. Twice before it had been captured by enemies, once in 1557 by the Spaniards and once by the Germans in 1871. Population before the war, about 56,000.

SAINT VALENTINE'S DAY. Like many other things that have originated far back in folk and village customs, it is impossible to date or explain accurately this festival on February 14. Nothing that we know of the several saints of that name helps us. Sometime in the Middle Ages, certainly as early as Chaucer, the young folk of the hamlets of England, Scotland, and parts of France assembled on St. Valentine's eve and drew names by chance from an urn. The person whose name was on the slip was the holder's "valentine" or sweetheart for a year. Later the upper classes took up the custom. Presents were exchanged and services performed like those of the medieval knight for his lady.

Some see back of this custom a somewhat similar one of the Roman youths in the feast of Lupercalia in February, and attribute the use of the name of a saint for the day to an effort of the early Christians to improve a pagan custom they could not wholly stamp out. When and how the old customs were changed into the sending of our valentines—both of ridiculous and pretty sorts—no one knows.

SAL′ADIN (1138–1198). "Before I saw his face I was sore afraid, but now that I have seen him I know that he will do me no harm"—these are the words of a Crusader who was taken prisoner and brought before Saladin, sultan of Egypt and Syria, the noblest foe that the knights of the Cross ever encountered. By the Mohammedans he was revered as a wise and clement ruler, a leader who was able to unite his people and turn back the tide of Christian invasion, and as a man who embodied the highest virtues and ideals of Islam.

His leadership came at a time when it was sorely needed, for the Mohammedan world, without political unity, was sinking into decay. Bit by bit, since the First Crusade had won Jerusalem for Christendom, the empire of the Seljukian Turks, who held the temporal power of Islam, had been falling apart. It was not the strength and zeal of the Christians so much as the weakness of their foes that had kept the Christian Kingdom of Jerusalem alive.

The original name of this leader was Yusuf ibn Ayyub, and Salah-ed-din (or Saladin) is merely the title given him, meaning "Honor of the Faith." He came of that strong and warlike race of Asia Minor, the Kurds; and his father was governor, under the Seljukian Turks, of the province of Tekrit in Armenia. Saladin himself early rose to prominence. He was sent by Nurredin, the Seljuk Sultan of Syria, on an expedition to Egypt, which resulted in the winning of that land for Nurredin and eventually in the appointment of Saladin as vizier of Egypt. When Nurredin died rebellion broke out against his young heir, and Saladin overran and gained control of Syria. The calif of Egypt having also died, Saladin was now the most powerful ruler in Islam, and the calif of Bagdad recognized him as the sultan of both Egypt and Syria.

SPOTTED OR "FIRE" SALAMANDER

It was not the bright yellow spots on its shiny black coat which earned for this little creature the name of "Fire Salamander," but the fable that it could live in fire.

Saladin's great purpose was to win back for Islam the lands embraced in the Kingdom of Jerusalem; and when in 1187 one of the Christian leaders broke faith, he seized the opportunity to proclaim a Holy War. Gathering forces from all parts of Egypt, Syria, and Mesopotamia, he overran Palestine. Jerusalem was besieged and captured (1187), and the entire Christian kingdom, except Tyre, was conquered. In his taking of Jerusalem, as in all his acts, Saladin showed himself chivalrous and merciful. There was no such slaughter of non-resisting inhabitants as had marked the taking of the city by the Crusaders almost a century before. The captives were set free on payment of ransom, and many of those who were too poor to pay were given their freedom through charity.

It was to regain Jersualem that the Third Crusade was undertaken by the Christian rulers of Europe, notably Philip Augustus of France and Richard I of England. But the struggle ended with Jerusalem and all of Syria, except the coast line, in the hands of Saladin. The treaty of peace signed in 1192, however, provided that Christian pilgrims might freely visit the Holy Sepulcher at Jerusalem.

Saladin was a favorite figure in medieval romance, and Sir Walter Scott in 'The Talisman' has given us a noble picture of his chivalry and faithfulness to his word, shown particularly in his dealings with his great adversary, Richard the Lion-Hearted.

SALAMANDER. You have probably seen salamanders of various kinds and called them "lizards," for they have long tails and are four-footed. They are, however, closely related to frogs and toads, and with them are classed as *Amphibia*, backboned animals with a moist scaleless skin, and with the young in the form of tadpoles. True lizards, along with snakes and turtles, are *reptiles*, with a dry scaly skin, and large eggs similar to hen's eggs that hatch out like the adults.

In the sense generally employed by naturalists, all tailed amphibians are salamanders, though the genus *Salamandra*, to which some confine the name "salamander," is found only in Europe and in the Asiatic and African lands nearest Europe. The spotted or fire salamander (*Salamander maculosa*) is the species common on the Continent of Europe. It is harmless when gently treated, but when roughly handled exudes a milky white poisonous fluid; creatures which have rashly swallowed spotted salamanders have been promptly killed by the poison.

In the United States there are two or three dozen kinds of salamanders and salamander-like amphibians, varying in size and other characteristics. The smallest are but two inches long. The ugly "hellbender," of the Allegheny regions, grows to two feet in length and weighs several pounds; and the black snakelike "Congo snake" of the South grows to three feet. The "giant salamander" of Japan grows five feet long, and lives more than 50 years.

We may follow the common spotted salamander (*Amblystoma tigrinum*) as an example of the life of most of these. It grows to nine inches, and is black, with large yellow spots on the back and sides. In the spring it leaves its winter hiding-place under stones and logs, and proceeds to the ponds. Here the eggs are laid as soon as the ice is out, in jelly-like masses similar to frogs' eggs, attached to cattails and weeds. In three weeks or more they hatch out into tadpoles or polliwogs about a half-inch long. They feed on other small animals and grow rapidly, and by August they are five to seven inches long. Although they have small legs, they have a long powerful tail and three pairs of large external feathery gills. They are powerful swimmers, and are quite fishlike. Then they lose their gills, grow lungs, become spotted, and live the rest of their life on land in damp places. They hide in the daytime, and come out at night to feed on insects and other small animals.

The small lizard-like "newt" or "water-dog" of the East lives in ponds, and has a very interesting life history. It hatches as a tadpole and lives in the ponds its first summer. By autumn it has become orange-colored and goes to land, where it lives for almost three years in damp places. Then it returns to spend the rest of its life in the ponds, and becomes olive-green with red spots. Newts are valuable aids in our warfare upon mosquitoes. A single newt will devour as many as 200 mosquito larvae in 24 hours and whenever newts are found mosquitoes disappear.

The "mud-puppy," a rather ill-looking specimen about a foot long, retains its three pairs of gills and lives in water throughout its life. All salamanders are harmless, notwithstanding their bad reputations. The ancient myth that salamanders could live in or even quench fire is supposed to have arisen from their possession of certain glands which make the skin always moist and cold. Scientific name of eastern newt, *Diemictylus viridescens;* western newt, *Diemictylus torosus*.

SAL'AMIS. The great naval battle of Salamis, one of the decisive battles of the world, was fought between the Greeks and Persians in 480 B.C., in the narrow strait between the island of Salamis and the coast of Attica. The Persians under King Xerxes were decisively defeated, and Europe was saved from Asiatic conquest. The chief credit for this result belongs to the cunning Athenian statesman Themistocles, who not only induced his fellow citizens to place their reliance in the "wooden walls" of the Athenian triremes, but also by a trick prevented the Peloponnesian vessels from retiring and so brought on the battle in the narrow waters where alone the Greek navies might hope to triumph over the giant fleet collected by Xerxes. (*See* Persian Wars.)

SALMON. For its beauty, its "gaminess," its value as human food, and the interest of its strange life history, the salmon is distinguished among fishes.

The typical salmon, hatched in fresh water, "runs away to sea" under the urge of some mysterious instinct when about two years old. An instinct just as imperious brings the fish swarming home by the thousand about two years later, to spawn in fresh water. They come in such numbers that sometimes they fairly choke the rivers. A count made one year during a salmon run from June 14 to August 10 showed more than 2,500,000 fish ascending Wood River, Alaska, which is not one of the largest salmon rivers of the Pacific coast.

The homing salmon swims upstream sometimes at the rate of 15 miles and more. It leaps up waterfalls six and eight feet high; it ascends rapids of even greater height. Nothing but death can prevent it from reaching its desired haven.

It leaves the ocean in splendid condition, a large beautiful fish with dark back and silvery black-spotted sides, and with an average weight of from 4 to 25 pounds according to the species, and an occasional weight in some species of 45 to 100 pounds. It eats nothing after entering fresh water. As it fiercely fights its way back home, hardship and privation gradually disfigure and deform it. Slimy, emaciated, and discolored, it becomes a hideous object, with distorted head and body, mutilated tail and fins, and skin from which scales have disappeared, and often scarred and torn or blotched with fungus. The salmon of some coasts may live to descend the rivers after spawning; those of the Pacific coast die exhausted on or near the spawning grounds. In Norway, Sweden, Maine, and Quebec there are "landlocked salmon" which never reach the sea, but spend their adult life in lakes, ascending streams to spawn.

The salmon fry are at first queer shapeless little monsters, known as "alevins," each with a comparatively huge yolk-sac under its body. For about six weeks the alevin hides among the stones, eating nothing until the yolk-sac is nearly absorbed. Then it puts on a dark-banded red-spotted coat, so unlike that of the adult salmon that the "parr," as the young fish is termed, was long believed to be a distinct species. When ready to go to sea it puts on a silvery coat and is known as a "smolt." In the sea it becomes a "grilse" until it reaches maturity.

The salmon is essentially a cold-water fish, confined to the Northern Hemisphere. Salmon swarmed during the runs in New England rivers when the first white settlers arrived, and it is said that salmon, with bass and shad, "more than half supported the province" in early days until seine fishing and damming of the rivers diminished their numbers. The Pacific salmon is one of the most valuable fish in the world today. The salmon pack of the three Pacific coast states, Washington, Oregon, and California, has an average value of about $10,000,000 annually; that of Alaska is much larger.

There are several species of Pacific salmon, each of which goes by many names. The blueback or sock-eye, a small salmon weighing on the average about five pounds, brings the highest price per pound because of the fine color and flavor of the flesh; it preponderates in the Alaskan catch, and, taking the entire coast, is probably the most numerous Pacific salmon. The chinook, quinnat, or king salmon reaches the largest size of all the salmon. Its weight averages from 20 to 25 pounds, and specimens weighing 100 pounds have been taken. The value of the chinook salmon catch in Washington, Oregon, and California is more than equal to that of all the other salmon caught there. These two species are especially valuable because the bright color of the flesh does not fade on cooking. The humpback is the smallest of the Pacific salmons; its flesh has an excellent flavor, but is pale and therefore brings a low price for canning, as does that of the chum or dog salmon. The silver salmon has bright red flesh which fades on cooking. Another Pacific salmonoid fish is the white-fleshed salmon trout, steelhead, or winter salmon.

Most salmon are taken in nets of various kinds; some are caught by trolling, or dipped up in the buckets of "fish wheels" (*see* Fisheries). In most canneries the fish are dressed, salted, and packed in cans by machinery. The cans are capped, soldered, tested for air holes, cooked at 250° F., pricked to allow steam and superfluous water to escape, reclosed by soldering the holes, recooked, washed, retested, lacquered, and labeled.

Since the fish are not fit for food after spawning, they must be taken during the run toward the spawning grounds. A large catch, therefore, reduces future catches. Fortunately, the salmon is particularly adapted to artificial propagation. The United States Fish Commission has established large salmon-breeding stations in Maine and California, and has successfully reared and distributed millions of artificially hatched salmon fry.

The family to which salmon belong, the *Salmonidae*, is closely related to the herring family, and includes trout and whitefish besides two genera of salmon, the Atlantic salmon (*Salmo salar*) and the Pacific salmon (*Oncorhynchus*). The name "salmon trout" is applied to the European sea-trout and to various fresh-water salmonoid fishes as well as to the Pacific coast steelhead.

SALONIKI (*säl-ō-nē'kē*), GREECE. To the north and east a rampart of bare hills that happily hide the naked wilderness inland; to the south and west the blue waters of the safe and roomy harbor, in which ride the ships of a score of nations—such is the superb position of Saloniki, now the second largest city of Greece. This ancient city—the Thessalonica of the Bible, to whose converts St. Paul addressed his two Epistles to the Thessalonians—is the most important seaport of the northern Aegean, and served during the World War of 1914–18 as the base of Allied operations in Macedonia.

Saloniki (or Salonica, as it is sometimes written) is still girdled by its medieval wall, forbidding and solid, climbing to the old citadel which crowns the heights at the back of the city. From the citadel one looks out over old Saloniki—a maze of rambling crooked little alleys, mysterious and shadowy. Mere slippery cobbled paths, most of them are, sloughing the day's accumulation of filth into the open drain which meanders down the edge. Blank walls line them, with sometimes an iron-barred window, and stout-doored entrances to sleepy stone-flagged courtyards, where a sage-green sycamore is silhouetted against the blue wash of the wall beyond. Unexpected galleries and gables that lean far out across the narrow way throw jagged shadows over groups of gossiping women—some in long black Turkish dominoes or cloaks, others in the picturesque peasant costumes of Greece, of Albania, and of Bulgaria.

Lower down, the spires of Christian churches and the minarets of splendid Mohammedan mosques of great antiquity rise above the monotonous line of one- and two-storied houses, and the stores, clubs, and theaters of the shopping district near the Quay. The "Street of the Vardar," which cuts the town in two at the foot of the hill, is a piece of the old Roman road from the Adriatic to the Golden Horn, and earlier still was the "Royal Way" of the ancient Macedonian kings.

Near its eastern end this street is spanned by a triumphal arch erected in the days of the Roman Empire. All day long American street-cars rumble back and forth beneath it. The dignified fathers of Israel in greasy fur-lined gabardines rub elbows with kilted Greek peasants in tight white trousers tasseled under the knees, or booted Montenegrins with hanging sleeves. Arrogant Bulgars, in brown homespun and *opinskis*—rough sandals of untanned leather—stare at tall Albanians in white or black frieze and white skull caps over one ear.

Saloniki's past is long and tumultuous. It has survived centuries of sack and massacre, siege and revolution. It has had a dozen masters. Its present foundations rest upon the ruins of an ancient and prosperous city, founded by a king of Macedonia in 315 B.C. and named for the half-sister of Alexander the

SALONIKI, QUEEN OF THE NORTHERN AEGEAN

More than 2,000 years have swept over Saloniki; fire destroyed two-thirds of the city in 1917; but nothing can deprive it of its splendid situation and magnificent harbor which make it the chief seaport of the Balkan Peninsula.

Great. Xerxes stopped here to take stock of his men and equipment before advancing into Greece. For nearly 500 years it was in the hands of the Turks. The Treaty of Bucharest (1913) gave Saloniki to Greece and divided between Serbia and Bulgaria the greater part of the Macedonian hinterland. The chief exports are cotton, wool, wine, silk, cocoons, tobacco, and fruits. The population, which numbers about 250,000, consists chiefly of Greeks, Turks, Jews, Bulgars, Serbs, Italians, and French.

SALT—*Preservative of* FOOD *and* LIFE

The Wonderful Substance that Seasons Bread and Oceans, Blood and Tears—The Various Kinds of Salts

SALT. What is it? "Salt," said a little boy, "is what makes your potato taste bad when you don't put any on it." He was talking about common or table salt, a substance the tremendous importance of which is rarely appreciated, because it is so common.

To chemists, however, a "salt" means any one of a class of substances of which our table salt is a type — a substance formed by the reaction of an acid with a base (*see* Acids and Alkalies). Bring sulphuric acid (which is a partnership of sulphur, hydrogen, and water) into contact with soda lye or caustic soda (which is a partnership of sodium, hydrogen, and oxygen), and presto, change! Some of the hydrogen and oxygen atoms elope in the form of water, while the forsaken sodium and sulphur strike up a new partnership with the few faithful oxygen atoms to form sodium sulphate—a salt.

WHAT COMMON SALT WILL DO

A little rubbed on the cups will take off tea stains.

Put into whitewash it will make it stick better.

As a tooth-powder, it will keep the teeth white and the gums hard and rosy.

Salt is one of the best gargles for sore throat, and a preventive of sore throat if taken in time.

Salt and water cleans willow furniture; apply with a brush, and rub dry.

Salt and water held in the mouth after having a tooth pulled will stop the bleeding.

Two teaspoonfuls of salt in half a pint of tepid water is an emetic always on hand, and is an antidote for poisoning from nitrate of silver.

Neuralgia of the feet and limbs can be relieved by bathing night and morning with salt and water as hot as can be borne. When taken out, rub the feet briskly with a coarse towel.

Salt and water is one of the best remedies for sore eyes, and if applied in time will scatter the inflammation.

Silk handkerchiefs and ribbons should be washed in salt and water, and ironed wet, to obtain the best results.

As a fertilizer, salt is very valuable.

Hemorrhages of the lungs or stomach are often checked by small doses of salt.

The chemical name for common salt is "sodium chloride." It occurs in nature both in beds or strata (when it is called "rock-salt"), and in solution in water. Aside from the sea and salt lakes, the underground waters of many regions contain salt. The salt of commerce is partly mined from the beds of rock-salt, and partly extracted from salt waters. In the latter case the brine may be natural, as in the case of the sea, salt lakes, and salt wells; or it may be artificial. In the case of artificial brines, fresh water is allowed to flow over beds of salt, and from the resulting solution salt is extracted. In the extraction of salt from salt water two general processes are used. In one the water is allowed to evaporate in the open air under the influence of the sun; and in the other evaporation is hastened by means of artificial heat. By the former process the coarse salt, and by the latter the fine salt, of commerce are obtained.

Beds of rock-salt represent deposits made on the bottoms of salt lakes, lagoons, and the like. In some lakes, as Great Salt Lake, Utah, such deposits are being made at the present time. Similar deposits have been made in the past—some of them millions of years ago—and subsequently buried by layers of sand, mud, etc. Sometimes such beds are hundreds of feet thick. The salt in solution in underground waters may have been derived from salt beds over which the waters, seeping in from the surface, have passed. Some of the natural brines underground may represent sea-water with which the sediment was originally filled and which has never been drained out.

In the Carpathian Mountains, in what was formerly the Austrian Empire, there are salt mines with chambers and passages extending for thirty miles, the roof being supported by massive pillars of the rock salt. The thickest salt beds of the United States, so far as now known, are on the coast of Louisiana, on Avery's Island. Other salt beds occur at Syracuse and Warsaw, N. Y., in Pennsylvania, Kansas, Ohio, Michigan, Utah, and California, and in Ontario, Canada. The United States produces more salt than any other country. Great Britain, Russia, Germany, France, India, Spain, and Italy are also great producers.

Sodium compounds are needed in our bodies and in the bodies of all animals, and since most of our food does not contain much sodium we use table salt as a seasoning. Deer and other wild animals regularly resort to certain springs and "licks" for the sake of the salt to be obtained there.

Salt was used to season and preserve food long before the beginning of recorded history. Where there was no supply near at hand it was brought from great distances, and thus became one of the most important articles of early commerce. One of the oldest roads of Italy was called the *Via Salaria* ("salt road") because it was the route by which salt was transported. The caravan trade of the Sahara is still largely a trade in salt. In some remote parts of the world, such as Central Africa, salt is even today one of the most prized of luxuries. Cakes of salt have even been used as money in Abyssinia and other remote regions.

We can get an idea of the high importance attached to salt in early times from the fact that it gives us our word "salary," which comes from the Latin *salarium*, meaning "salt-money"—the allowance given Roman soldiers to buy salt. Among the ancients, as among some oriental peoples to the present day, a meal containing salt has a sacred character, and to "eat salt" with a man was to create a sacred bond of friendship. In the Middle Ages one's social rank was shown by whether one sat above or below the salt at the table. High taxes on salt were one of the causes of the French Revolution, and similar taxes are still levied in some oriental countries.

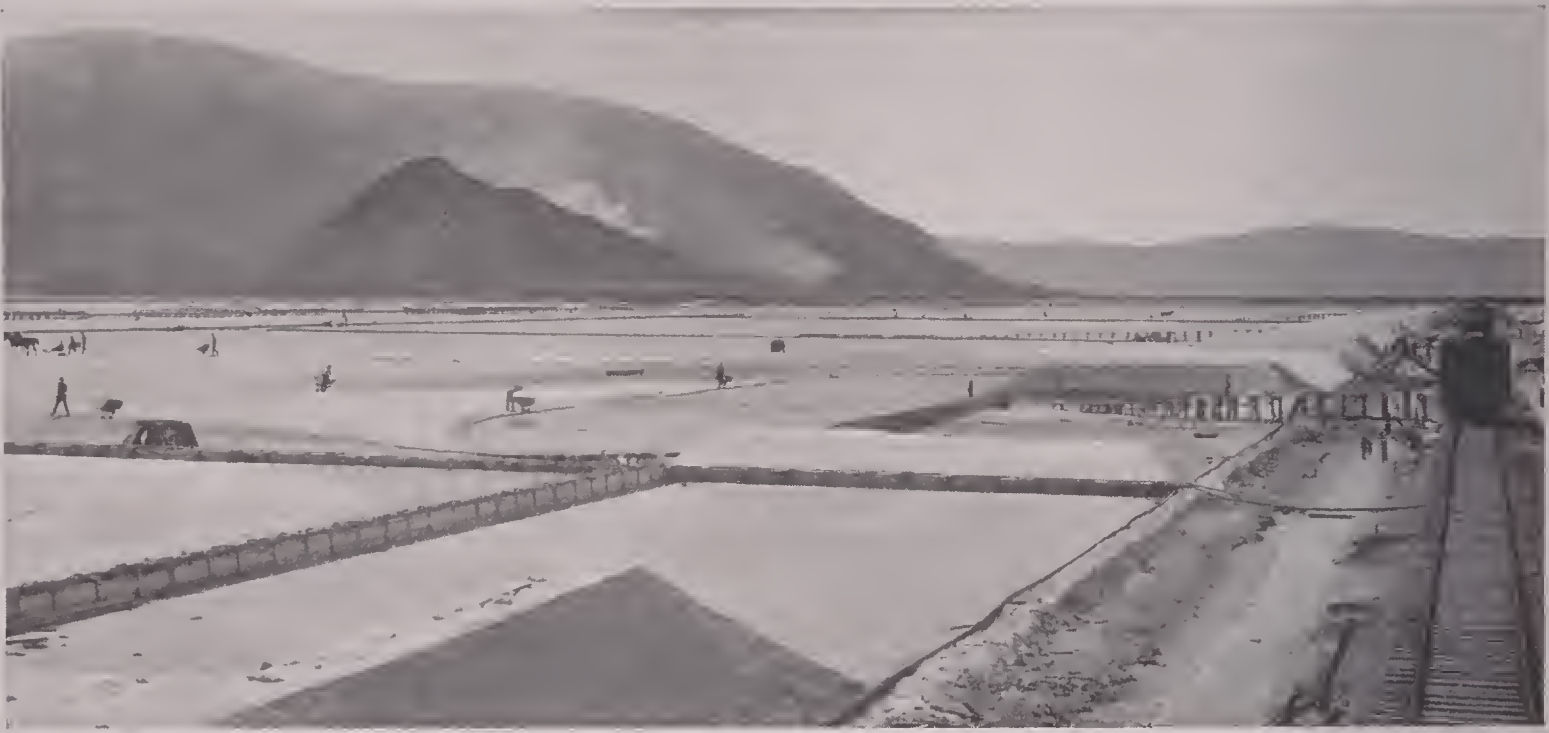
Several of the chemical compounds most important in industry are made from common salt. Sodium sulphate or salt cake (Na_2SO_4) is used in glassmaking. Glauber's salt, which is crystallized sodium sulphate, is also used in glassmaking, in dyeing, in the manufacture of other chemicals, and in medicine as a purge. This is the chief medicinal agent in certain mineral waters, such as those at Carlsbad, Germany. Sodium sulphide (Na_2S) is used in the textile and leather industries and in the manufacture of synthetic dyes. The hyposulphite of sodium is the familiar "hypo" bath used in photography.

Epsom salt, which is found in every household medicine cabinet, is chemically a hydrous sulphate of magnesium. It occurs abundantly in nature, getting its name from Epsom, England, where it is found in the water of a spring. Seidlitz powders or Rochelle powders are drugs composed of tartrate of soda and potash, mixed with bicarbonate of soda and wrapped in a blue paper, and powdered tartaric acid wrapped in a white paper. When the contents of the two papers are dissolved separately in water and then poured together, the effervescing mixture is drunk as a mild aperient.

SALT LAKE CITY, UTAH. In 1847 Brigham Young led a band of Mormons westward across the plains and mountains to seek a new home free from persecution. When the wanderers came out on the western side of the mountains overlooking the valley of the Great Salt Lake, Young exclaimed, "Here we will stop and build our city." Today Salt Lake City is the leading commercial city of the United States between Denver and the Pacific coast, and the capital of Utah. This city, noted as the headquarters of the Mormon organization, has a dry healthful climate, being situated over 4,000 feet above sea-level. To the south and east rise the snow-capped peaks of the Wasatch Mountains, while to the northwest a level stretch of country extends 12 miles to the shores of Great Salt Lake. The wide streets, many of which are bordered with trees freshened by streams of running water from the neighboring mountains, the well-kept gardens surrounding the residences, and the extensive parks aid in making the city attractive.

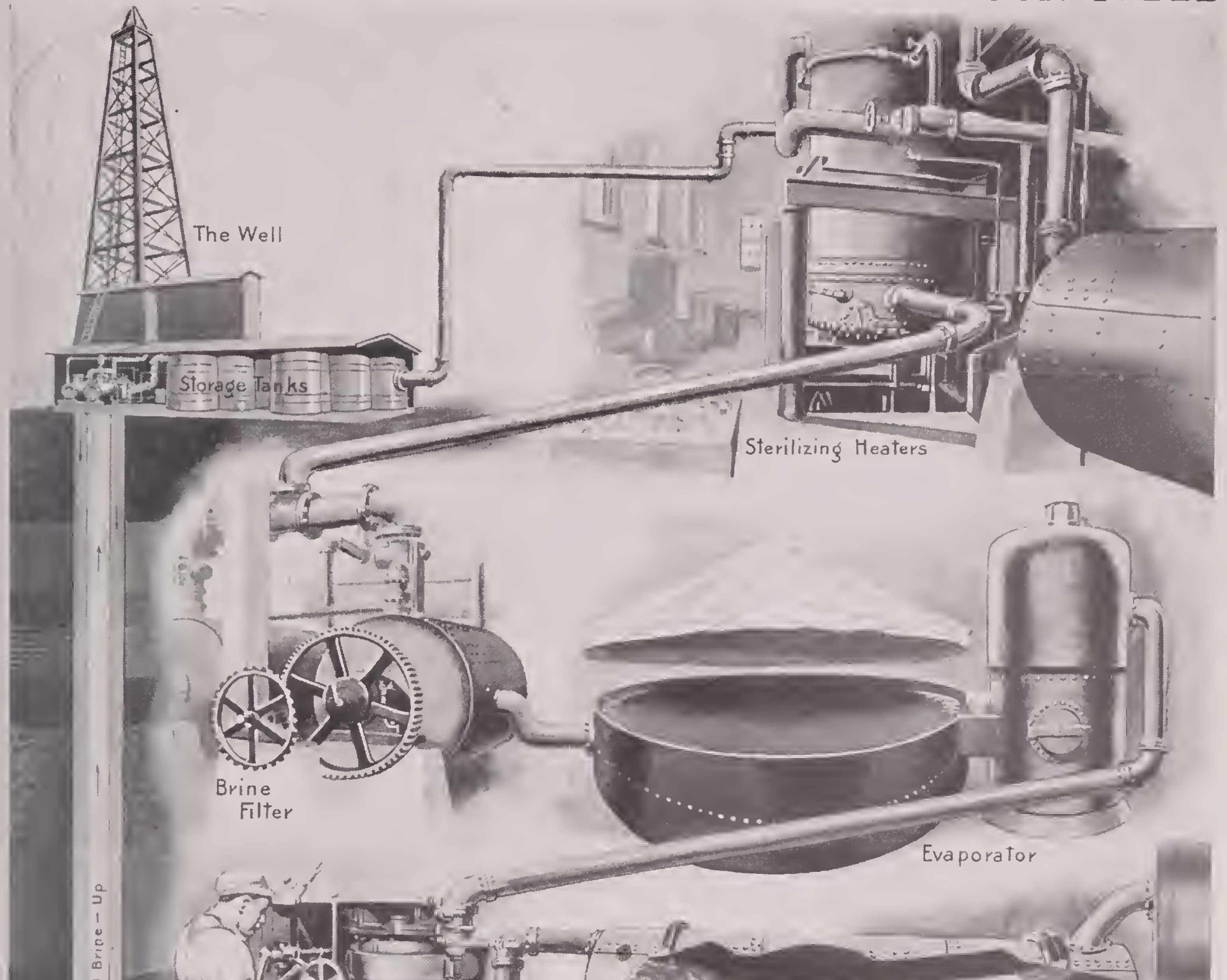
In the center of the city, surrounded by beautiful grounds, are situated the chief buildings of the Mormon church. The Tabernacle, a large oval building which seats 8,000 people, is noted for its remarkable acoustic properties and the large pipe-organ it contains. This building and also the Assembly Hall, which is devoted to divine service, are open to the public. Only Mormons, however, are admitted to the Temple, which is an imposing granite structure used for marriage, prayer, and baptism. Other buildings of note in the city are those of the University of Utah,

HARVESTING SALT ON THE SHORES OF GREAT SALT LAKE



These are the salt gardens (that is really their name), from which for three months from September 15 salt is harvested from the waters of the Great Salt Lake, with their 17 per cent salt content. The water is first pumped to about 15 feet above the lake level, then, transported by gravity about two miles inland through a flume, it passes by various stages into the gardens or harvesting ponds.

HOW THE "SALT OF THE EARTH" REACHES YOUR TABLE



A salt well has two pipes, one within the other. Pure water is forced down the outer pipe into a cavity in the rock salt bed, and the saturated brine is forced up the inner pipe by the pressure. The brine is then forced through a series of heaters, which precipitates the gypsum, and this gypsum is removed in gravel-laden filters. Evaporators then get to work on the purified brine to form the salt grains. These are next treated in centrifugal driers, which revolve at high speed and drain off most of the water through fine screens. All remaining moisture is removed in steam driers, which revolve slowly on an inclined plane, while a jet of heated air plays on the descending salt. After the fine flakes have been sifted through copper-screened bolters, the finished salt is automatically weighed and packed in containers ready for kitchen use.

a coëducational institution, the city and county building, the museum, the exposition buildings, and the huge warehouses of Zion's Coöperative Mercantile Institution. The street railway system is excellent.

TEMPLE SQUARE, SALT LAKE CITY

The Mormon Temple is the tall many-steepled building on the right, over 150 feet high from foundation to pinnacle; to the left is the low spreading dome of the Tabernacle. In the foreground, lower left corner, is the Pioneer (Brigham Young) Monument.

Salt Lake City, through its central position, has become important as a trade center. One of the chief industries is mining, at the nearby town of Bingham, where a whole mountain is being cut down to obtain the copper ore. The most prominent manufacturing plants are the smelting works, flour, woolen, and paper mills, foundries, machine shops, marble and cement works, tanneries, and manufactories of shoes, crackers, cereals, salt, candy, pickles, and soap.

The original barren plain, by proper irrigation, has been changed to a garden spot. At first the growth of the city depended upon the inflow of Mormon converts from Europe and America, but later the mines in its vicinity attracted the Gentiles, and the non-Mormon element is now about 45 per cent of the city's population, which numbers approximately 120,000.

SALTPETER. Ordinary gunpowder and fireworks depend for their explosive action in large part upon the saltpeter which they contain. To the chemist common saltpeter is known as "potassium nitrate," and he will tell you that its chemical symbol, which shows what it is composed of, is KNO_3. (*See* Chemistry.) He will also tell you that it forms colorless six-sided crystals, that its taste is cooling and very salty, that it dissolves in water but not in alcohol, that it is used in many ways besides in fireworks and gunpowder, and that it is found naturally in the soil of many countries, and especially in the caves of Kentucky, Virginia, and Indiana.

Common saltpeter, however, is usually manufactured from another form which is found in Chile (South America) in great beds, sometimes 10 feet thick, covering an area 260 miles long by 2 to 3 miles wide. The chemists call this "sodium nitrate," and write its symbol thus, $NaNO_3$. It cannot be used in this form for making gunpowder because it gathers moisture from the air; but just because of this fact it is all the more valuable as a fertilizer.

There is yet a third kind of saltpeter called "calcium nitrate" which is sometimes formed on the walls of stables. It also is used as a fertilizer.

SALVADOR (*säl-vä-dōr′*), **REPUBLIC OF.** Although smallest in territory, Salvador is, after Guatemala, the most important of the Central American republics. Almost all of its area—about that of Maryland—is suitable for cultivation, and it is more densely populated than any of its neighbors. Despite the fact that it has no coast line on the Atlantic and is thus deprived of ocean communication with the outside world, its foreign trade is far greater than that of Honduras and Nicaragua.

Salvador occupies a section of the broad plateau along the Pacific coast, broken here and there by clusters of volcanoes and mountain ranges. Decomposed lava has made the soil very fertile. There is plenty of rainfall from May to October, and the slopes of the mountains are well adapted to the cultivation of coffee, which forms 80 per cent of the country's exports. In lower altitudes nearly all the characteristic Central American products can be grown. Peruvian balsam (a resinous substance produced by certain trees, much used in confectionery and medicines) from the so-called Balsam Coast, is an important article of commerce. The production of indigo has fallen off since the discovery of coal-tar dyes. Cheese, cacao, rubber, tobacco, and sugar are other products. The eastern section contains gold, silver, and lead.

Salvador has the most curious, the most dangerous, and the most beautiful volcanoes in America. It is a land where the earth trembles frequently, where lakes rise and fall, and where peaceful rivers suddenly become rushing torrents. There is no more wonderful volcano in the world than Izalco, the "Lighthouse," so called because its red glow makes it visible to sailors by night. This cone began to rise out of the plain over a century ago and is now more than a mile high, having built itself up by its own ashes. The majestic San Salvador, overlooking the capital city of the same name, had been dormant since the occupation of the Spaniards and was thought extinct. Suddenly, in 1919, this volcano belched forth from fissures in its sides enough lava to fill two Panama canals. The eruption, with the accompanying earthquake, destroyed nine-tenths of the city. Twice before within a century earthquakes destroyed San Salvador.

La Union, the best Pacific port in Central America, is to be connected by railroad with the capital, San Salvador. The capital is already connected with Santa Ana, the second largest city, and with Acajutla, an important seaport in the north.

The people have more Spanish blood and less negro than in Nicaragua and Honduras, and the upper classes show a greater tendency to adopt European practices. All speak Spanish, and there are only a few communities where the aborigines retain their primitive customs. Salvador was named by its Spanish conqueror, Pedro de Alvarado, after the "Holy Saviour" (San Salvador). Its early history was as turbulent as that of its neighbors. After the declaration of independence from Spain in 1821, it was in a state of almost continuous war. It is now, however, one of the most orderly and best governed of Central American republics. Area, about 13,150 square miles. Population, about 1,300,000.

SALVATION ARMY. On the curbstone of a dreary gin-smelling street in London's East End, in 1865, stood an alert young Methodist revivalist named William Booth. Jeers, shouts, and a shower of stones and refuse greeted him when, after a spirited address and a hymn sung to a rousing popular tune, he began to pray for the rough men and women gathered about him. Yet despite this treatment Booth and a few followers (including his heroic wife) went there day after day, to invite the people to meetings which they held,—now in a tent pitched on an old deserted burial ground, now in a cheap dance hall or old warehouse,—to bring religion to the poor of London's slums, and to do what they could to relieve misery.

"GENERAL" WILLIAM BOOTH

Not until death removed the old warrior, at the end of 83 strenuous years, did he resign the command of the Salvation Army.

Such were the humble beginnings of the great Salvation Army under its "General," William Booth (1829–1912). Its organization and uniform were semi-military, and after 1878, when it first received its name, the growth was phenomenal. Upon its own merits it has won its way around the world, and today in more than 60 countries and colonies—in Europe, Asia, Africa, the Americas, and Australasia,—it is found vigorously living up to its aim, "To bring spiritual and material benefit to those whom conservative religious bodies do not reach."

The work of this widespread "army" of able selfsacrificing men and women, who go quietly about in their plain yet distinctive uniforms, is not only to stand on the street corners singing hymns to the accompaniment of a brass band, to take up collections in tambourines, and to carry on soul-saving services both outdoors and indoors. They go farther. Realizing that sheer privation has driven many of the poor and lowly to desperate courses, the "army" has done wonders in the way of social relief. Thousands of confirmed drunkards who enter its ranks become, as a condition of membership, total abstainers. Other thousands of ex-convicts are given a fresh start in life. Among the many establishments for lending a helping hand to "down-and-outers" are rescue homes, day nurseries, lodging houses, fresh air camps and homes, free clinics, homes for the helpless aged, labor bureaus, farm colonies, slum settlements, poor men's lawyers, free coal and ice distribution, Christmas dinners to the needy poor, anti-suicide bureaus, etc.

During the World War of 1914–18 the Salvation Army went overseas to serve the Allied soldiers as unobtrusively as it had been working for unfortunates in the dark unwholesome alleys of the slums. Millions of men were directly aided by their ambulances, stretcher service, and above all by the refreshments, entertainment, and "mothering" they received in the Salvation Army "huts." Here—often right in the danger zone—soldiers could read, write, sing, play games, go to a simple prayer meeting, and have their clothes mended, dried, and even washed by motherly women, with whom they would impart their secrets, and leave their trinkets and last messages. Here, too, they could buy for the lowest possible cash or "jawbone" (credit) many things, such as candy and razor blades, as well as hot coffee and cocoa and the much heralded pie and doughnuts. The Salvation "lassies" and "majors" were always "on the job" although it was a busy one. In a single day two young girls could make as many as 1,500 doughnuts, 2,500 cookies, 50 pies, as well as countless cups of coffee and cocoa! Hot drinks and sandwiches were served free of charge at night to men on duty or to those who came up in the dark with ammunition trains, etc. Everywhere the Salvation Army war service "made a hit." At the same time in various parts of the world it was attending to its customary duties at home.

A SAMOAN SCHOOLHOUSE

The trim schoolhouse standing out so primly against luxuriant tropical foliage shows the white man's influence; but the low pavilion in the foreground is thatched like the oval native houses with pandanus palm leaves.

The Salvation Army is supported by voluntary contributions and by its 58 publications, among which are the *War Cry*, the *Young Soldier*, the *Social Gazette*, and *All the World*. Piety and ability alone are required of the officers, who are termed "generals," "colonels," "captains," "lieutenants," etc. The army is divided up into various groups, such as provinces, divisions, and corps. Their religious beliefs are those of evangelical Christianity. In 1917 there were 9,673 posts throughout the world, 1,173 social institutions, and 16,768 officers and cadets.

In 1896 Ballington Booth, son of General Booth, and his wife Maude Ballington Booth, who had been in charge of the Salvation Army in the United States for some years, separated from the parent organization and established a new one called "The Volunteers of America." Its religious and philanthropic work is similar to that of the parent society, but the Volunteers seek affiliation with the churches and religious denominations of the country.

Samoa (*sä-mō′ȧ*). In the South Pacific, in a direct line between San Francisco, 4,200 miles to the northeast, and Australia, 2,400 miles to the south, is a chain of islands formed by some ancient volcanic upheaval and then ringed about by a coral breakwater. Behind this in the course of the ages new fertile flats made yellow shores and the land and mountain-sides were covered with great forests and ferns and creepers. This chain is the Samoan Islands—mere points under a tropical blue sky, where sunshine and warm winds with impartial hand caress the glaring beach, the sharp reddish leaves of the mango, and the rustling fronds of the coconut trees. It is a winterless land of sunshine and simple life; but in the spring may come one of the terrific South Pacific hurricanes that level houses and trees and dash great ships on the beach — such as that of 1889, when three American warships and two German were wrecked with a great loss of life. Earthquakes also are not unknown, but the volcanoes for the most part are sleeping.

These 14 small islands were first seen in 1722, and were once called the Navigator Islands. The six most easterly (one of which is uninhabited) have belonged to the United States since 1900. On the south side of the largest of these, Tutuila, is the splendid harbor of Pagopago, which has been a coaling station of the United States navy since 1878. The larger islands to the west were assigned to Germany at the same time the others passed into the hands of the United States following a quarter of a century of conflicting claims between Germany, Great Britain, and the United States, and civil war among Samoan chieftains. When Germany was defeated in the World War of 1914–18, her share of these islands passed to New Zealand as a "mandatary" of the League of Nations.

Near the important port of Apia, on Upolu, one of the former German islands, Robert Louis Stevenson long made his home and he is buried at Vailima, under the shadow of Mount Vaea.

Between the forested mountains of the interior, on any of these islets, and the sea is the little flat stretch where the natives live in huts, made of the wood of the *bourao* tree, with their frail roofs of pandanus leaves in which the lizards have their nests. A stone's throw behind them begins a confusion of plants and flowers underfoot, a rank tangle of coconuts overhead, hibiscus, guavas, bamboos, giant ferns, bread-fruit, ironwood which grows denser and denser until it is finally impenetrable, even to the natives, except along the bed of rushing brooks.

The natives are splendid clean-limbed Polynesians with olive-brown skins. They are very intelligent and appreciative of education. They profess the Christian religion. Protestants, Catholics, and Mormons are represented, but all faiths are touched by old native beliefs. Tattooing is still common for young men before marriage. Bird and animal life is very scant.

The total area of the archipelago is only a little more than 1,000 square miles; its population, about 50,000 natives and perhaps 2,000 whites. Copra and coco beans are the chief articles of export. The American islands are under a naval governor.

SAN ANTONIO, TEX. Standing at the gateway to the west and on the highway to Mexico, San Antonio, the largest city in Texas, has something of the spirit of both. It retains many traces of Spanish and Mexican influence, particularly in the small plazas, a block square and vivid with bloom, which are scattered over the city; in the narrow streets and flat one-story adobe buildings of the Mexican quarter; and in the architecture of most of the public buildings and many of the business houses. To the loyal Texan, the city is a shrine of early Texas history, for it was the capital of the province during practically the whole of the Spanish and Mexican occupation and was the scene of desperate fighting in the struggle for freedom from the Mexican yoke. Beauty, romantic memories of the past, and industrial and commercial progressiveness thus unite to make San Antonio distinctive among American cities.

Situated 150 miles from the Gulf coast and about the same distance from the Rio Grande, nearly 200 miles from any rival business center, San Antonio is an important distributing point for southwest Texas and northern Mexico, and is a leading live stock, cotton, wool, and mohair market. In manufacturing too, it ranks high, having large flour mills, oil mills, brick and tile manufactories, packing houses, oil refineries, broom factories, machine shops, foundries, iron works, and cement works.

The city is beautifully located on a plateau nearly 700 feet above sea-level, rimmed by misty blue ridges. A few miles from the city, a number of clear springs bubble up, forming the clear, shining San Antonio River which winds about through the city for miles, spanned by many bridges. It was this supply of pure water that decided the Spanish explorers and the cowled and frocked Franciscan monks, long ago, to form a settlement here.

Brackenridge `Park, adjoining these springs, is almost virgin forest. Vine-laden trees, festooned with Spanish moss, overhang the drives and the winding stream. In this park is a splendid collection of buffalo, elk, antelope, and other wild animals. San Pedro Park, a picturesque live-oak grove, was the first public park of the city, being a royal grant from the king of Spain in 1729. In it rises the stream of San Pedro, which flows through the western part of the city and unites with the San Antonio.

The government has maintained a military station for troops in San Antonio from the close of the Mexican War to the present time, except during the Civil War. The present post, Fort Sam Houston, is one of the largest military posts in the United States. During the World War of 1914–18, Camp Travis, Camp Stanley, and Kelly Aviation Fields and Balloon School were established here. The government also maintains an extensive range for artillery firing at Leon Springs, 20 miles to the north.

San Antonio is the oldest city of Texas. A Spanish presidio (garrison) was established at the head springs of the San Pedro, and a Franciscan mission founded near by in the early part of the 18th century.

During the long war of the revolution of Mexico against Spain, the old city was the scene of many fierce conflicts, and in the war for Texan independence, which began in 1835, eight battles were fought in or near it. The most famous of these is the desperate siege of the Alamo mission-fortress, in which Davy Crockett and 178 other heroic Texans were massacred (March 6, 1836). In 1842 the city was retaken by the Mexicans and 52 of its chief citizens were driven more than 1,000 miles on foot into the state of Vera Cruz, where they were kept prisoners for two years. In 1878 the first railroad reached the city, and since then its growth has been rapid. Population, about 165,000.

SAND. Wind and rain and frost disintegrate solid rocks, decomposing the less stable minerals and leaving the more resistant ones in larger fragments. These fragments, rolling against each other through the ages in stream beds or along shores of seas or lakes, lose their rough edges and become gravel and sand. The last name applies to the rounded particles of resistant mineral matter, mostly quartz, between about one-tenth and one one-hundredth of an inch in diameter.

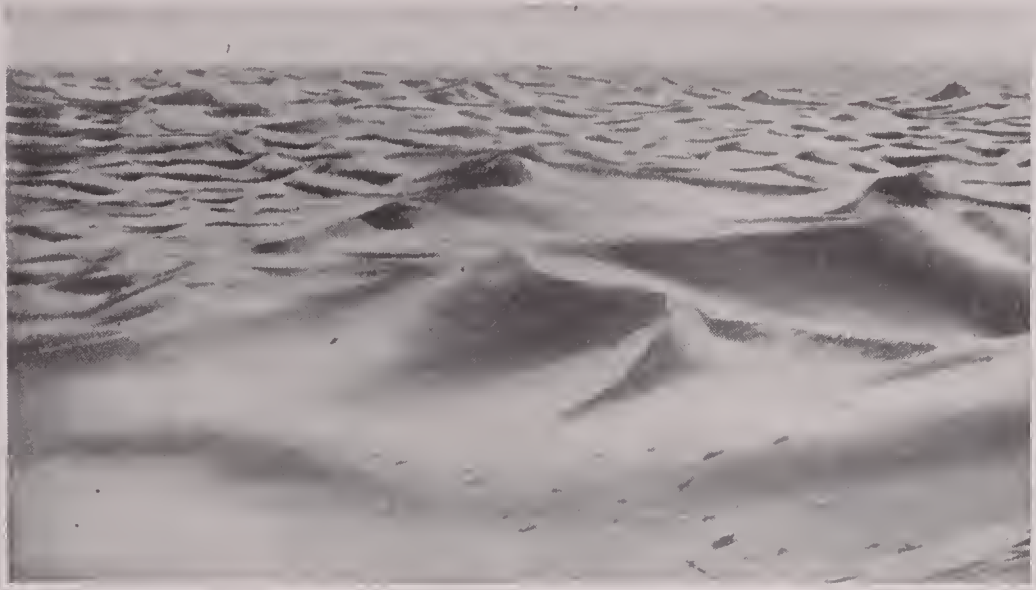
Sand has a number of curious properties and important uses. Dry sand is blown about extensively by wind and deposited as "dunes." Dunes, which are mounds, hills, or ridges of wind-deposited sand, are common along sandy shores, and in other places where dry sand abounds. Dunes abound in many deserts, such as the Sahara, and in semi-arid regions, such as western Nebraska. Unless anchored by vegetation, dunes are likely to migrate by the slow shifting of the sand from the windward to the leeward side of the dune. Migrating dunes have invaded many a fertile farm and fruitful orchard. In New Jersey, windblown sand has overwhelmed orchards near the coast so that only the topmost twigs protrude. Similar devastation has been wrought or threatened by advancing sand at various places on the Atlantic and Pacific coasts.

Near Manistee, Mich., a bonfire built by picnickers on a stationary dune burned the grass which held it in place. The hill shortly began to advance, and before the sand was pinned down by replanting, its movement seriously threatened the city waterworks and other property. In New Zealand, sheep pastured on grass-covered dunes have done similar damage. The great estate of Culbin, on the northern coast of Scotland, celebrated for its fertility, was engulfed in sand toward the end of the 17th century, and ever since, the entire region, more than 3,000,000 acres, has been a shifting waste. Large cities lie buried under the sand hills of the desert of Gobi, in Central Asia.

How the Wandering Hills are Kept at Home

Fortunately, wandering dunes may be fixed: (1) by the erection of artificial barriers, fences, or hurdles; and (2) by the planting of grass and other vegetation which will grow in sand. Both means were employed in the redemption of the "Landes" of Gascony (France) on the Bay of Biscay. A hundred years ago this region was a vast sandy wilderness marching inland at the rate of about 16 feet a year; today it is a great pine forest, a source of lumber and turpentine, sheltering a rich inland farming region. Only vegetation will hold the soil permanently, and few plants are tenacious and hardy enough for the pioneer work. The dunes near Provincetown in Cape Cod, Mass. are controlled by the systematic planting of beach grass followed by shrubs and trees. The Golden Gate Park in San Francisco is protected from wind-blown sand by judicious planting.

A SANDY SEA OF ALGERIA



Riding along the southern frontiers of Algeria during a high wind, one may enjoy the impressive sight of hills brought low and valleys raised up into hills under one's very eyes.

The dune region of Lake Michigan, including the entire Indiana shore and parts of the adjacent shores of Michigan, is, because of its situation, exceptionally favored with moisture, and therefore has a remarkably varied and beautiful plant life. Nature lovers have inaugurated a movement to make a tract in these dunes into a national park. Though this is not an arid region, the sand brought to the head of the lake by shore-currents is dry for days at a time; it is then that the wind plays with it. Wet sand is never blown about by the ordinary wind.

Sandy shores are constantly being made and unmade by wind and water together. A map of 1715 shows the upper part of Cape Cod as an island. In 1848, what is now James Island off the coast of South Carolina was a peninsula. The foot of an old lighthouse at Cape Henry, Va., was swept by the tides when it was built a hundred years ago; now it stands high and dry on a sandy hill, and it has been necessary to build another lighthouse at the water's edge.

Sand mixed with water is in many ways quite a different thing from dry sand, particularly with reference to the bearing of weight. If you have ever walked on a sandy shore, you know how your feet sink at every step into the dry sand. On the other hand, the wet beach from which the tide has ebbed is somewhat yielding, yet almost as firm as a cork or asphalt pavement. On the Florida coast at Daytona the beach is used for automobile racing. Firmness is characteristic of sand wet with just enough water to fill the spaces between the grains.

Quicksands, which have been known to swallow up living men, like the Master of Ravenswood in Scott's 'Bride of Lammermoor', might almost be thought another substance from ordinary sand. Indeed, the name itself ("quick" is here used in the old sense of "living," as in the phrases "the quick and the dead," "cut to the quick," etc.) hints as much. In fact, there is no mysterious difference between sand and quicksand. The foot sinks through the upper layer of dry sand, but stops when it reaches sand which is held comparatively close-packed and stable by the weight of the sand above; otherwise one would continue to sink. Quicksand is merely sand in which the grains below the surface slide readily on each other as the dry sand grains do on the top of the dry beach. Perhaps a hidden spring wells up under the sand with just enough force to keep the grains loose. Perhaps decaying weeds and other organisms buried under the sand are generating gas which has the same effect. Perhaps there is just enough slimy mud and air mixed with the sand to make a medium in which the sand grains roll and any heavy object is held fast by air pressure.

Mysterious Music of the Sands

So-called "musical sands" and "singing beaches" occur in various parts of the world. Sand on the beach near Manchester, Mass., gives a crackling sound; the "singing sands" of Mount Sinai are said to give a sound like an Aeolian harp, increasing to thunder notes, and the Djebel Nakus or Bell Mountain in Arabia Petraea gives forth a sound like a chime of bells, terminating in a roar, which the Bedouins attribute to a ruined Christian monastery. Elsewhere the sound is likened to that of a humming telegraph wire. The cause has been much discussed, but agreement has not been reached. In some cases the singing depends on the amount of moisture in the sand. It will not sing if dry or if very wet, but will if barely moist. This is true of the sand at the head of Lake Michigan.

SAND DUNES OF INDIANA NEAR LAKE MICHIGAN

An advance guard of the sparse and hardy but exquisite dune vegetation is sweeping over these Indiana dunes, and may soon reclaim them from their gypsy ways into staid and respectable hills.

Quartz is the mineral of which common sand is composed, but there are sands which contain other minerals in abundance. The Columbia River sands contain a large number of minerals, including magnetite, gold, zircon, garnet, pyrites, and some other rarer ones. The so-called "white" sands of New Mexico are nearly pure gypsum. Arkose sand contains feldspar, hornblende, mica, etc.

Not content with breaking down the rocks into sand, Nature develops sandstone from sand. Under heavy pressure, the grains are crowded close together, and then are cemented by mineral matter such as calcium carbonate, iron oxide, and silica, deposited from solutions from the waters percolating through the sand. On cementation the sand becomes sandstone. Sandstones are of various colors and degrees of hardness. Certain sandstones are much used for building purposes. Other varieties are used for grindstones and oilstones.

The uses of sand are legion. Twenty inches of dry sand will stop an ordinary bullet, and during the World War sandbags were an important means of defence. The sandblast is a device by which sand is driven through the nozzle of a tube by a blast of air or steam; its uses range from the cleaning of building-fronts and rusted iron to the engraving of glass and the cutting of inscriptions on stone. Sand is an important ingredient of mortar, cement, and asphalt pavements, and is used in pottery and for molds in iron foundries. Bricks made of sand are harder and will bear a greater weight than bricks of clay.

Sand with a high percentage of silica is demanded for glass-making, the grade of glass varying with the purity of the sand. The size and evenness of the grains is also important. Glass sand is widely distributed over the United States, but sand which can be used in the manufacture of high-grade glass is found in but few places. In the manufacture of glass the quartz is fused with certain other substances, such as sodium. Green bottle glass is made from impure sand, the color being due to iron. (*See* Glass.)

SANDALWOOD. The fragrant and fine-grained sandalwood, so prized by the Chinese and East Indians for making elaborately carved boxes and the fragile carved sticks of fans, comes from certain tropical islands of the Pacific Ocean and East Indies. It was the discovery, in 1804, that these myrtle-like evergreens were native to the Fiji Islands that led to the first European settlement there.

Ground into powder and moistened to a paste, the Chinese make of sandalwood long slender spirals that burn like incense in their temples and on the altars of their household shrines. Hindus make of the paste, colored bright vermilion, the caste-marks on the forehead which distinguish the Brahmans from other castes; and when princes die in India their funeral pyres on the steps of the burning-ghat are built of sweet-scented sandalwood.

There are several species of sandalwood trees—white, yellow, red, etc.—all belonging to the genus *Santalum.* Successful attempts have been made in India to cultivate sandalwood plantations. The trees never exceed 30 feet in height and a foot in diameter. The fragrance of the wood is due to its essential oil, valuable also in medicines, the roots being even richer in it than the branches and trunk.

SAN DIEGO (*săn dē-ā'gō*), CALIF. Three unique gifts the good fairies gave to San Diego—an incomparable view from Point Loma, a climate which is like "Alaska in summer, Arabia in winter," and a land-locked harbor, the southernmost on the Pacific coast of the United States, wide enough and deep enough to float the navies of the world, and entered and silted up by no important stream. Then the spiteful fairy decreed that its grass-grown streets should drowse in the sun during nearly a hundred years of Spanish rule, awaiting the touch of the Fairy Prince.

The Sleeping Beauty is awake today. San Diego now has more than 200 manufacturing plants, several huge and sumptuous hotels, and is a terminus for two railroads—the San Diego and Arizona, eastward to Yuma, and the Santa Fé. It is the nearest Pacific port of call for ships passing through the Panama Canal, and for this reason San Diego had a Panama-California Exposition all its own in 1915–16. The improvements made for the exposition were not destroyed at its close, and most of them remain in Balboa Park.

Army and Navy Activities

The Federal government has developed here a large number of important activities, including a permanent marine corps base, naval hospital, radio station, and army and navy aviation schools. San Diego is also a naval base and the home port and operating base for part of the Pacific fleet. The city controls the whole of its magnificent harbor—32 square miles in extent, with 38 feet of water over the bar at low tide—and all the improvements, including a municipal pier costing nearly $1,500,000. On the opposite side of the bay lies Coronado Beach. According to 60 years of official United States Weather Bureau reports, San Diego has the most equable climate not only in California but in the entire United States.

Historically San Diego is the "Plymouth of the Pacific coast," for it is the site of the first permanent white settlement on the Pacific coast of what is now the United States. Here in 1769 the saintly Father Junipero Serra founded the first of the 21 missions along the *Camino Real*—the "King's Highway." The Old Town, with its church, plaza and adobe houses, still stands; and one of the houses, popularly called "Ramona's Marriage Place," is supposed to be one of the scenes of Helen Hunt Jackson's Indian romance 'Ramona'. Population, about 75,000.

SAN FRANCIS'CO, Calif. The great twin valleys of the Sacramento and the San Joaquin rivers meet midway in the state of California to make a concerted thrust westward at the Coast Range, and lo! the wall opens on the greatest land-locked harbor in the world—San Francisco Bay. Enthroned on the southern horn of the Golden Gate, guarding this harbor, sits San Francisco. Not another city in the world—except perhaps Constantinople—so combines beauty of situation with strategic advantage on the grand scale.

The first Pacific port of the United States in importance and the fifth of all its ports for both exports and imports, San Francisco's commerce is chiefly with the near South and the near and far East—with Mexico and Central America, with China and Japan, the Philippines, the British and Dutch East Indies, and Australia and New Zealand. Along the waterfront any day may be seen the living souvenirs of this traffic with far outlands—black Gilbert Islanders and brown Kanakas, turbaned Lascars, heavy-featured Russians, Alaska Indians, and swarthy blue-sashed Italians—making, with the unassimilated Chinese and Japanese, as strange an assortment as any melting pot can be asked to fuse.

Because California produces neither coal nor iron, San Francisco's rank as a manufacturing city does not equal its standing in commerce, but the state's recent rise to importance in petroleum production and development of hydro-electric energy has removed this handicap. The refining of Hawaiian sugar in this nearest port of entry, the slaughtering and packing of live stock, and the canning of fruit and vegetables raised in the inland valleys, together with shipbuilding, constitute the city's chief industries. San Francisco, it may be noted, has the largest fruit and vegetable cannery in the world, and one of the largest ship-building plants on the Pacific coast.

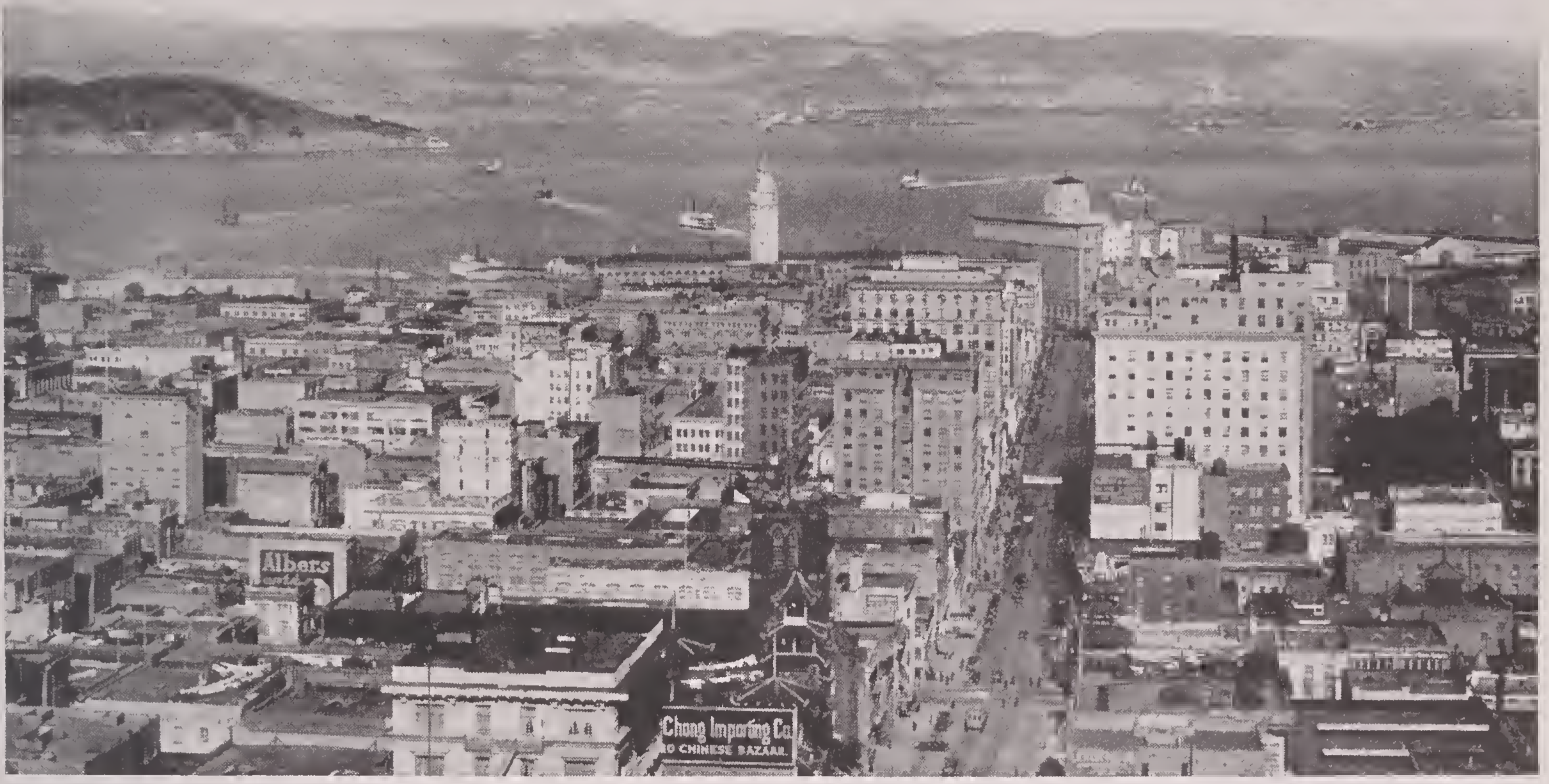
The Effect of the Earthquake

The great earthquake of 1906, and the fire which raged over a third of the city in its wake, destroyed many of San Francisco's links with the past. Old Chinatown is gone; the new one, though strange and exotic enough, is vastly more sanitary and is inclined to frown on "tong" wars and "highbinders." Nob Hill, the home of the Canadian Pacific and Nevada silver-mine millionaires of the '70's, was swept by the flames, only one of these mansions being spared.

Yet a greater and more splendid San Francisco has arisen from the ashes, and now looks hopefully toward the new gateway of commerce in the south. The shortening of trade routes to Atlantic ports through the opening of the Panama Canal means so much to San Francisco that the city celebrated the event by an international exposition in 1915.

Mention should also be made of the Ferry Building, called the busiest ferry station in the world, through which 50,000,000 persons have passed in a year and whence frequent boats run across the bay to Alameda, Oakland, and other residential suburbs; the Golden Gate Park, "one of the glories of San Francisco," 1,013 acres in extent, running from the center of the city three miles westward to the ocean; the Cliff House on the ocean side and the seals of Seal Rocks; the famous and splendid hotels; the United States Mint, second in size only to that of Philadelphia; the old Presidio reservation on the shores of the Golden Gate, now used as the United States Army headquarters for the Department of California; the Mission Dolores, founded in 1776, with its old bells hung by rawhide ropes to the rafters; the old restaurants with weird names and wonderful cookery, and a hundred other things that make this city like no other in the world. And not the least among its features are the streets themselves—streets that run at right angles, regardless of the hills on which the city is built, and in many places are so steep that one almost climbs, rather than walks up them.

SAN FRANCISCO LOOKING EASTWARD ACROSS THE BAY



From Nob Hill one sees the tower of the Ferry Building on the water front, with Berkeley and Oakland across the bay and the end of Goat Island at the left. A fleet of ferry-boats is constantly plying back and forth between the metropolis and its lovely suburbs.

San Francisco, it has been said, has grown from an Indian pueblo, through the days of Spanish dons and forty-niners, to be a great cosmopolitan city with a bit of Hongkong in its midst and of Italy on its skirts. At the same time it is "the gayest, lightest-hearted, most pleasure-loving city of the western continent, and in many ways the most interesting and romantic." It is said that every San Franciscan who is away from home grows homesick for a breath of San Francisco's morning fog. Population, about 510,000.

SANTIAGO (*sän-tē-ä'gō*), CHILE. One of the most beautifully situated of the world's cities is this capital of Chile and largest city on the western slope of South America, situated in a charming plain through which flows the river Mapocho. Mountains surround it, and in the center rises the picturesque rocky hill of Santa Lucia, which was once a citadel but now is the city's pleasure ground.

Chief among the broad straight streets is the Alameda, over 300 feet in width, broken by four lines of poplar trees. In the center is a promenade dotted with lines of statues, many of which are spoils of the Peruvian war, while driveways 100 feet wide lie on either side. Along this avenue are many magnificent residences built in the old Spanish style around a "patio" (court) containing fountains and flowers. There are many beautiful churches and public buildings, for Santiago is the social and educational capital of Chile, as well as the seat of government. In addition to the University of Chile there are several professional and normal schools. The luxuriant parks in and near the city are maintained by irrigation, for the rainfall is scanty. The city has suffered severely from earthquakes on numerous occasions.

The Trans-Andine railroad connects Santiago with Valparaiso, the leading seaport of Chile (about 70 miles northwest), and with Buenos Aires, the capital of Argentina, on the east coast of the continent. Population, about 420,000.

SAN'TO DOMIN'GO. After nearly a century's attempt to maintain itself as an independent nation, the Republic of Santo Domingo (or Dominican Republic), located on the eastern two-thirds of the island of Haiti, found itself in a nightmare of aimless rebellions, assassinations, and boundary wars with the rival republic of Haiti. The government defaulted in its payment of interest on bonds held in European countries, and at last in 1905 the situation was so serious that foreign intervention became inevitable.

With Europe threatening to collect its debts by taking over Santo Domingo's administration, the desperate republic turned to the United States for aid. A treaty was framed under which the United States took control of its financial affairs, and soon Santo Domingo not only was able to pay $1,200,000 a year on its debt, but found itself with a net income for government use greater than it ever had before.

But Santo Domingo had formed the habit of making trouble, and the United States was forced to intervene to end disorders. Finally, in 1916, it established a military government to administer the executive and legislative departments, while the judicial branch and, for the most part, the local government was left in the hands of the natives.

The tropical island with whose fortunes the United States has thus become linked is for four-fifths of its area a mass of snow-capped mountain ranges, precipitous ravines, and broad rivers flowing through twilight jungles. Between the ranges lie plains, some of which are the best sugar lands in the West Indies, while others are without agricultural value. The chief products are coffee, cacao, sugar, and tobacco. Copper, gold, and other metals exist, but, like the valuable forests, they are still unexploited.

The Dominican Republic, occupying two-thirds of the island, has an area of about 19,000 square miles—about twice the size of Vermont. The population is mainly a mixed race of European, African, and Indian blood. Spanish is the prevailing tongue. Its capital, Santo Domingo, one of the oldest existing European settlements in the New World, founded in 1496, was originally surrounded by walls of which several curious old stone gateways remain. Massive stone houses with colored walls border the straight narrow streets. The republic's independent existence dates from 1844. Population, about 955,000. (*See* Haiti, Republic of.)

SARATO'GA SPRINGS, N. Y. About 38 miles north of Albany, N.Y., in the midst of a region famed for its medicinal mineral springs and for its great historic interest, lies the city of Saratoga Springs, one of America's most popular health resorts. Thousands go each year to Saratoga in search of health and pleasure, and the hotels can accommodate more than 20,000 guests. Large bottling works ship the medicinal waters to various parts of the world. In 1909 the state of New York bought the springs and the land around them and established a reservation, to regulate their exploitation. Long before the arrival of the white man, the medicinal qualities of these waters were known to the Indians, who called the place "Sa-ragh-to-ga," meaning "hillside country of the great water."

Near Saratoga Springs were fought two battles of the American Revolution, on Sept. 19 and Oct. 7, 1777. The latter is ranked by the historian, Sir Edward Creasy, as one of the 15 decisive battles of the world, because in it the Americans under General Gates defeated the British under General Burgoyne, and forced him to surrender. This surrender ended the British campaign to divide New England from the rest of the colonies by gaining possession of the Hudson River, and led France to conclude its treaty of alliance with the colonies which enabled them to win their independence. (*See* Revolution, American.) Population, about 15,000.

SARDINES. For most of the world sardines grow in cans, swim in oil, and are caught ready cooked with an instrument that looks like a key! But, as a matter of fact, they came originally from the sea, where they are known by a number of names. The trade name "sardine" is usually applied to almost any small fish which is packed whole in cans.

There are, however, true sardines or "pilchards" (*Clupea pilchardus*) to which the name properly belongs. They are small olive-green members of the herring family and are found abundantly in the Mediterranean Sea and on the west coast of France. They obtained the name "sardine" because they were first caught in large quantities off the island of Sardinia, in the western Mediterranean. The largest sardine fisheries now are those off the coast of Brittany. The failure of the sardines to appear for a season here has reduced 80,000 persons to destitution. They are caught when young, and after the entrails are removed, they are washed, dried, and cooked in boiling oil. They are then drained and placed in cans with fresh olive oil. When the lids are soldered on, the cans are plunged for a time in boiling water or in steam before soldering the vent hole.

In the United States, the young of the herring, menhaden, and pogy, caught off the New England coast, are packed in vegetable oil and marketed as "American sardines." These form the greater part of the cheaper sardine trade in this country, the imported kind being much more expensive. There is, however, a variety of the true sardine or pilchard found on the Pacific coast and called the California sardine (*Clupea sagax.*) These fishes grow about 12 inches long and are excellent as food, but are less frequently canned.

Full grown pilchards are caught in great numbers in the English Channel. They are salted and heaped in piles to dry, and are sold in the same forms as herring. They also produce a valuable fish-oil. (*See* Fish; Fisheries.)

SARDIN'IA. Despite Sardinia's central position in the smiling Mediterranean, despite its ancient history stretching back for centuries before Christ, it remains today a forbidding land. True, the people are honest, courteous, and hospitable, but they are poor and unprogressive. Although the island belongs to Italy, the Italians from the peninsula look upon it as a place of exile. Malaria long raged there, killing a higher percentage of people than in any other part of the kingdom. Comparatively few of the peasants know how to read and write.

Yet Sardinia has wealth and great possibilities. Her forests are the largest on Italian soil. Her mines, dating back to ancient times, yield quantities of iron, zinc, and lead, while silver, manganese, antimony, copper, and coal are found in profitable quantities. The tunny, lobster, and sardine fisheries are also thriving industries. But these are mostly in the hands of foreigners. The short dark-haired natives, who resemble the Spaniard more than the Italian, dwell mostly on small farms, raising a little grain and herding their cattle, sheep, and goats among rocky hills where the wild boar, stag, wild sheep, eagle, and vulture still make their homes.

The Sardinians are believed to be descendants of the ancient Mediterranean race, whose stone forts covered the island during the Bronze Age. The first definite history of Sardinia begins with its conquest by the Carthaginians in the 5th century B.C. It later became a Roman province, and was one of the leading sources of the Roman grain supply. The inhabitants remained pagans until the 7th century A.D. In the

Middle Ages the island was the scene of fierce struggles between Saracen invaders and the fleets of Pisa, which came in response to a crusade preached by the pope (1004) to oust them, and for three centuries possessed the island. In the 14th century the king of Aragon won it, and it remained Spanish until the War of the Spanish Succession transferred it to Austria in 1713. In 1720 Austria forced the Duke of Savoy to take it in exchange for Sicily. The island then gave its name to the newly formed "Kingdom of Sardinia," which included the more important territories of Savoy and Piedmont. It was this kingdom which became the nucleus around which Cavour, Garibaldi, and Victor Emmanuel established in 1861 the kingdom of modern Italy (*see* Italy).

Sardinia is 160 miles long and 68 miles wide, with an area of 9,299 square miles. The only stream worthy of mention is the Tirsu, 94 miles long, which empties into the Gulf of Oristano on the west coast. The highest point is Mount Gennargentu (6,000 feet) in the center of the island. The Strait of Bonifacio, 7½ miles wide, separates it from the island of Corsica on the north. East of this strait is a group of small islands which includes Caprera, at one time the home of the Italian patriot Giuseppe Garibaldi.

Sardinia is divided into two provinces, named after their respective capitals—Cagliari in the south, and Sassari in the north. There are over 600 miles of railroad, and steamers connect the island with Naples, Genoa, Palermo, Leghorn, Tunis (Africa), and Corsican ports. Population, about 880,000.

SARGENT, JOHN SINGER (born 1856). The spirit and training of many lands combined to make John Singer Sargent a famous painter. He was born in Italy of American parents, spoke his first words in German, received his art education in France, found fame in England, and made only brief visits to America. Yet, when asked why he did not become a British subject, since he spent most of his life in England, he replied that he preferred to remain a citizen of the United States.

SARGENT
Painter of the "Inner Face"

Though regarded as a portrait artist, he is chiefly known in America as the man who "painted the prophets." This reputation is based on the famous decorations painted by him in the Boston Public Library. On the walls of its great hallway, which now bears his name, appear in impressive and solemn array the great figures of the Jewish and Christian religions. They form part of a general scheme depicting the "Pageant of Religion." The splendor of the arrangement on the wall space rivals in many ways the work of the great wall painters of the Renaissance. The Hebrew prophets are perhaps the best known of the groups, and reproductions of the figures of "Hosea" and others are familiar sights in all art stores. These mural paintings, begun in 1890, were not completed until 1916. (For illustration *see* Prophets.)

Sargent's portraits are perhaps the most celebrated of their day. His sitters have included men and women of great distinction in the literary, artistic, and social life of Europe and America. With masterly technique he combines a marvelous skill in picturing the mind and soul of his subject. Whatever he sees, whether pleasant or unpleasant, is put into the finished portrait. For this reason he has been called a "dangerous" painter for those who have anything to conceal. As was said of Stuart, another great American portraitist, Sargent paints the "inner face." There is a legend that a doctor, puzzled by a certain case, found the secret of his patient's baffling personal nature revealed in a portrait done by Sargent.

Among the notable portraits by Sargent are those of Theodore Roosevelt, Joseph Jefferson the actor, and Ellen Terry the actress, as Lady Macbeth. His best figure pieces include 'Carnation Lily, Lily Rose', in the Tate Gallery, London; 'Carmencita', Luxembourg, Paris; and 'Gitania', Metropolitan Museum, New York City. 'The Fountain' and 'Trout Stream in the Tyrol' are in the Chicago Art Institute.

SARSAPARIL'LA. The next time you enjoy a glass of cooling sarsaparilla "pop," think that to obtain the root from which this pleasing flavor is made an Indian toiled somewhere in the tropical forests of Central America. For sarsaparilla extract is prepared from the long fibrous roots of a twining shrub or vine,—a near relative to the northern smilax found in old-fashioned gardens,—which grow in swampy forests from the northern and western boundaries of Mexico south to Peru. The brownish roots, about as thick as a goose quill, extend horizontally on all sides of the plant for about nine feet. The earth has to be scraped away and other roots disentangled very carefully to avoid injuring the sarsaparilla root. When dried it is ready for market. To obtain the extract the dried roots are boiled.

Sarsaparilla roots were taken from the New World to Europe as early as the 16th century. For many years the extract was used as medicine in stomachic disorders, and still retains that reputation among many people, although modern medical science maintains it has no medicinal value. There are several varieties of sarsaparilla in commerce, named from the countries from which it is exported.

The two principal species are *Smilax officinalis* and *Smilax medica*, growing respectively in Jamaica and Mexico. The "wild sarsaparilla" or "false sarsaparilla" of the eastern United States and Canada is a nearly stemless woodland herb, *Aralia nudicaulis*.

In SASKATCHEWAN'S VAST *and* FERTILE FIELDS

Extent.—North to south, 760 miles; east to west, 275 to 390 miles; area, 251,700 square miles. Population, about 825,000.

Physical Features.—Bounded north and south by the 60th and 49th parallels, and on the west by 110th meridian. Rolling country, rising in the west and broken by low hills; southern prairies separated from the northern forests by a park region interspersed with woodland. Athabasca, Reindeer, Wollaston, Quill, Last Mountain, and numerous smaller lakes. Principal rivers: Qu'Appelle, Saskatchewan, and Churchill.

Products.—Wheat, oats, barley, rye, flax, hay, potatoes, etc.; cattle and dairy products, horses, sheep and wool, hogs; furs; coal, cement, and clay products; lumber and timber; flour, packing-house products, foundry and machine-shop products.

Chief Cities.—Regina (capital, about 40,000), Saskatoon (25,000), Moose Jaw (20,000), Prince Albert (8,000), North Battleford, Swift Current, Weyburn.

SASKATCH'EWAN, CANADA. One may travel mile after mile through parts of the province of Saskatchewan, in western Canada, and see nothing but the endless fields of waving grain which make it the greatest wheat-growing district of the Dominion. But Saskatchewan covers more than 251,000 square miles—nearly the size of Texas—and naturally that large area, extending 760 miles north and south, is not all wheat land. Of the 94,000,000 acres reckoned to be fit for agriculture, less than 30,000,000 have been put under cultivation. In the southwestern section, in many seasons grain cannot be grown without irrigation; but stock ranching is exceedingly profitable, and here are many large ranches of from 1,000 to 20,000 acres. Great undeveloped low-grade coal deposits underlie much of the southern portion. In the central part of the province dairying has become so important that the government has established under the Department of Agriculture a number of coöperative creameries. Between the Saskatchewan and Churchill rivers mixed farming is much more common than the growing of wheat alone, and oats, barley, rye, flax, potatoes, and garden vegetables of the finest quality are raised. The cattle industry is increasing all over the province. The live stock branch of the Department of Agriculture each year purchases thousands of heifers and cows, which are sold to the farmers of Saskatchewan on very easy terms. North of the Churchill River lies a little-settled region covered for the most part with forests of spruce, and dotted here and there with lakes, of which the largest are Athabasca (2,842 square miles), Reindeer (2,437 square miles), and Wollaston (996 square miles).

Except when the chinook winds modify the temperature, the long winters are severe, though the cold is made endurable by the dryness of the air.

About one-half of the people of this great province are of British descent and many others are from the United States and various European countries. One of the most interesting groups is the Doukhobors, who are frequently called "Russian Quakers" because their religious beliefs resemble those held by the early "Friends" of England and the United States. They formerly held all of their property in common but have largely conformed to Canadian conditions in this and other matters. They are pacifists and non-resistants, and do not recognize obedience to government as a duty. In Russia they were persecuted and driven from one province to another, until in 1899 they secured permission through the influence of Count Tolstoy, to emigrate to Canada; there are now about 11,000 of the sect in Saskatchewan, Manitoba, and British Columbia.

Less than one-third of the population of the province live in cities, the chief of which are Regina (the capital), Moose Jaw, Saskatoon, and Prince Albert. But as manufactures, especially of lumber products and flour, are beginning to develop, the towns are growing rapidly. The provincial government has adopted a system under which it owns and controls the long distance telephone lines and controls and supervises all other lines.

One of the outstanding features of Saskatchewan's agricultural history is the growth of coöperation among the farmers. Flourishing coöperative organizations now exist for the storage and marketing of grain, for dairying, wool marketing, potato growing, cattle sales, insurance, and the purchase and distribution of farm supplies.

Like the rest of the Canadian Northwest, Saskatchewan was originally a part of the possessions of the Hudson's Bay Company, known as Rupert's Land. The region was still unsettled when it was acquired by the Dominion of Canada in 1869; but with the completion of the Canadian Pacific Railway in 1885, settlers began to move into the region. Population increased until in 1905 the province of Saskatchewan, formed from a part of the old territory of Assiniboia, was organized. There are about 11,000 Indians in the province, mostly Crees. In 1885 they joined the halfbreeds in a short-lived rising against the government under Louis Riel, who had headed a similar rebellion in the Red River district in 1870. The rebels were quickly subdued and Riel was hanged for treason (*see* Red River of the North).

The province takes its name from the Saskatchewan River, and in the Cree language means "rapid river." With its tributaries the Saskatchewan drains an area of nearly 160,000 square miles. The river proper (about 240 miles), with the South Saskatchewan, has a length of about 1,100 miles; it flows east through the middle region of the province and empties into Lake Winnipeg. With the Nelson River, which flows out of Lake Winnipeg, the Saskatchewan forms the most important river system emptying into Hudson Bay. Shallow draft steamers can ascend from near its mouth to Edmonton on the North Saskatchewan, a distance of 850 miles.

SAS'SAFRAS. In addition to the "sassafras tea," taken as a spring "tonic," this shrub or tree is useful for the aromatic oil from its roots used as a flavoring for medicines, stick candy, etc. It is found from Massachusetts to Florida and westward throughout the Mississippi valley, often in dense thickets, for a single tree if allowed to spread will soon be surrounded by a flourishing family sent up from its roots. The sassafras grows rapidly, reaching a height of from 30 to 50 and occasionally 100 feet, and is rather picturesque with its irregular branches and flat-topped head. The leaves are of three distinct shapes, oval, "mittens"—oval leaves with a lobe at one side in just the right place for the thumb—and double mittens, with a thumb on each side. In the autumn the sassafras is very beautiful, for its foliage turns all colors of the sunset—purple, red, and golden, while dark blue shining berries appear set on coral club-shaped stems. The berries are usually eaten by the birds before they are ripe. The leaves, bark, wood, and roots all have a pungent flavor. The wood is light and tough and is used for posts, barrels, and small boats, because it does not rot in moist soil or water.

Scientific name, *Sassafras officinale* (Laurel family). Bark thick, dark red-brown, deeply cut into irregular broad ridges. Wood dull orange-brown, soft, coarse-grained. Leaves alternate on slender petioles, 4 to 6 inches long; 1 to 3 lobes divided by broad sinuses; margins entire. Flowers inconspicuous, greenish-yellow, growing in loose racemes; blooming in May.

SATURN. This ancient Roman deity has been identified with the Greek god Kronos, who, it was said, after his dethronement by Zeus fled to Italy and there established his reign, known as the "Golden Age" of Saturn (*see* Zeus). But the name Saturn comes from a Latin word meaning "to sow," and, unlike Kronos, he was a god of agriculture who taught his people to till the soil. He is represented with a sickle in his hand. His wife was Ops, the goddess of plenty. In honor of Saturn, a great yearly festival, called the "Saturnalia," was held in December after the sowing of the winter grain was finished. This was a time of games and feasting; presents were exchanged, including especially wax candles and dolls; distinctions of rank were laid aside, and liberties were allowed even to slaves. It was formerly believed that the celebration of Christmas, which comes at about the same time, was introduced by the Church to displace the pagan license of the old Saturnalia.

In astronomy, the planet Saturn is the sixth major planet in distance from the sun, and is distinguished by its magnificent system of rings and satellites. (*See* Planets.)

SAULT SAINTE MARIE (*sọ sǎn mä-rē'*). Lake Superior's outlet into Lake Huron is the angry little Saint Mary's Strait or River, 63 miles long, flowing in a southeasterly direction through the one-mile-wide channel which here separates Canada from the Upper Peninsula of Michigan. The level of Lake Huron is some distance below that of Lake Superior, and in making the descent the river drops 20 feet in a mile, forming rapids (the *Sault* or "rapids" of Saint Mary) impassable to lake vessels. The Lake Superior region was thus barred from the seaboard until the first ship canal was built around the rapids in 1855, overcoming the difference in level by means of its locks and enabling vessels to pass from the one lake to the other. Today there are two canals at the "Soo" (as it is popularly called); one on the north or Canadian side of the river, and the other on the American side.

The original American canal was completed in 1855 by the state of Michigan, and transferred to the United States government in 1882. The present canal is about two miles long, but there are 30 miles of dredged channel leading to it from the Huron side with a depth of 22 feet at mean low stage. The canal has four locks, arranged in pairs (the last completed in 1919), each about 80 feet wide and ranging in length from 515 feet to 1,350 feet. The latter is the longest lock in the world, being 350 feet longer than the locks of the Panama Canal. It provides passage for the largest lake steamers, and sometimes accommodates five vessels at a time. A jackknife bridge, one of the largest bascule bridges in the world, spans the American canal.

On the Canadian side a canal with locks for small boats was built by the Northwest Fur Company as early as 1798, but it was destroyed in 1814 by American troops. The present Canadian canal was completed in 1885; it is 1⅓ miles long, and has a lock 900 feet long and 60 wide. Both canals are free, and vessels go through either the Canadian or American locks, as is most convenient.

These two artificial links in the Great Lakes system complete the water chain or highway by which vessels can sail continuously from Duluth on Lake Superior to the Atlantic Ocean (*see* Great Lakes; Welland Canal). The American canal carries some 15,000 vessels a year to about 5,000 through the Canadian; but prior to 1914 the Canadian canal had much the heavier traffic. About three times as much shipping passes through these canals, measured by tonnage, as goes through the Suez Canal, although navigation is closed by ice for four months each year. Coal makes up the bulk of the west-bound cargoes, and iron and copper ores most of the east-bound.

On the Canadian side of the river stands the city of Sault Sainte Marie, Ontario (population, 20,000), with a great pulp and paper mill (one of the largest in the world), nickel steel works, using the nickel ores from the Sudbury mines, and foundry and machine shops. On the American side, connected with Canada by a great international bridge more than a mile long, stands Sault Sainte Marie, Mich. (population, 12,000). Both cities use the water-power of the rapids to generate electricity for industrial purposes. Sault Sainte Marie, Mich., was the first settlement within the present state of Michigan, having been founded by Père Marquette in 1668.

SAVAN'NAH, GA. Historic Savannah, situated 18 miles above the mouth of the Savannah River, is one of the leading commercial cities of the South, and one of the most beautiful in the United States. It is the second largest city in Georgia and an important Atlantic seaport, drawing exports from a large and rich section of the country, including the greater portion of the southeastern states of the Union.

The city has an extensive wharf frontage, accommodating the largest sea-going vessels. From this port, in 1819, sailed the *City of Savannah*, the first steamship to cross the Atlantic Ocean. Savannah is a big cotton market, and exports large quantities of cotton, cottonseed meal and cake, lumber, fertilizers, coal, iron, flour, tobacco, naval stores, and general merchandise. Its industries include fertilizer plants, cottonseed-oil mills, tobacco manufactories, iron foundries, saw mills, planing mills, a sugar refinery with an output of 1,500,000 pounds a day, etc. Other products are wood pulp, wood turpentine, flour, car wheels, and steel plates.

The streets of Savannah are wide and beautifully laid out, with small parks or squares intersecting them at regular intervals. These little parks, scattered all through the city, were originally intended as rallying-places for the Colonists. Together with the larger parks, the parade ground, and the numerous park boulevards, they give the town a spacious and airy appearance; and the abundance of tropical foliage due to the mild and balmy climate—the enormous live-oak trees, draped with long pennons of Spanish moss, and the great palm trees—give Savannah its name of "Forest City." Numerous monuments to Revolutionary and Confederate heroes adorn the parks and public squares. Population, about 85,000.

Savannah was founded in 1733 by Gen. James Oglethorpe, an English philanthropist, as a haven of refuge for prisoners of debt in England. He was assisted in planning the city by a Charleston engineer named Bull, in whose honor the chief street of Savannah is named.

In 1778 the city was captured by the British, who retained possession of it until the close of the Revolutionary War. During the Civil War the city was an important depot for supplies of the Confederate forces, and was Sherman's objective in his march "from Atlanta to the sea." The Union forces took possession of the city Dec. 21, 1864.

SAVONAROLA
The Reformer of Florence

SAVONARO'LA, GIROLAMO (1452–1498). "Oh, my Florence! I was in a safe harbor, the life of a friar; the Lord drave my bark into the open sea. Before me on the vast ocean I see terrible tempests brewing. The wind drives me forward and the Lord forbids my return. On my right the elect of God demand my help; on my left demons and wicked men lie in ambush. I communed last night with the Lord and said, 'Pity me, Lord; lead me back to my haven.' 'It is impossible; see you not that the wind is contrary?' 'I will preach, if so I must; but why need I meddle with the government of Florence?' 'If thou wouldst make Florence a holy city thou must give her a government which favors virtue.' Then was I convinced and cried, 'Lord, I will do Thy will; but tell me, what shall be my reward?' 'My son, the servant is not above his master. The Jews made Me die on the Cross; a like lot awaits thee.' "

In burning allegorical words such as these the Dominican friar Savonarola swept the pleasure-loving people of Renaissance Florence by the tempest of his eloquence. Appalled by the sin of the world—and disappointed in love, so it is said—he had become a friar in Bologna at the age of 22. His first attempts at preaching were failures, but gradually he gained confidence and his fame spread abroad in Italy. In 1490 he was ordered to Florence by his superiors, and was elected friar of the monastery of San Marco (St. Mark's). His Lenten and Advent sermons in the cathedral of Florence, in which he denounced the sins of Florence and prophesied speedy punishment, soon gave him such a hold upon the city as few preachers have ever had.

In imagination we can see the shrunken figure and the gaunt face of the little hooded friar, his glowing black eyes flashing like lightning from beneath the shadow of his cowl. His prophetic words concerning the coming "scourge of God" seemed fulfilled when Charles VIII of France crossed the Alps in 1494 and invaded Italy. The emotional Florentines seized the opportunity to expel their despot, the feeble son of Lorenzo de' Medici, and restore their republic; and under the guidance of the prophetic preacher of San Marco they entered into alliance with the French.

Savonarola became practically dictator of the city, and set about his task of giving Florence "a government that favors virtue." Day by day his impassioned words roused the people to greater and greater religious enthusiasm. Light-hearted pleasure-loving Florence became a city of Puritans. Hymns echoed through the streets where lately had sounded riotous songs. In 1497 Savonarola sent the children from house to house to collect the "vanities" of the inhabitants. These were piled high in the public square—the fancy dresses and masks worn at the carnival, immodest books and pictures, and the like—and burned at the close of a solemn procession through the city.

But powerful enemies were now arrayed against Savonarola. The friends of the Medici were plotting their return. Pope Alexander VI ordered the zealous monk to discontinue preaching because of the Florentine alliance with France, and excommunicated him. At the same time a reaction against Puritanism swept over the city. A proposed ordeal by fire between a hostile monk and one of Savonarola's disciples, to test the truth of Savonarola's teaching, came to nothing, after all arrangements were made and the people assembled.

The fickle Florentines now turned against him. His enemies gained control in the elections, the monastery of St. Mark's was stormed, and Savonarola arrested. Through the use of torture they obtained from him whatever confessions they wished. In spite of the fact that his teachings were essentially the same as those of the church, he was condemned and burned as a heretic in 1498.

SAWFISH. Fishermen in warm waters occasionally find the carcass of some sea creature floating on the surface with its abdomen ripped open and its intestines torn out. This is the work of the gruesome sawfish, a huge member of the ray family, sometimes reaching 20 feet in length. His "saw" is a flat prolongation of the snout, covered with tough skin called *shagreen.* Into its two edges are set 26 pairs of long sharp teeth, with which the fish tears the flesh from the bodies of its victims. The tail of the sawfish develops tremendous strength for driving him and his saw back and forth at this cruel task. The dissecting weapon of these monsters is often six feet long and a foot wide at the base. Their small weak mouths are set on the under side of the head, back of the eyes, as is the case with their relatives the sharks. Their front fins are horizontal, serving only to balance the fish in the water. In other respects also they are shaped like sharks.

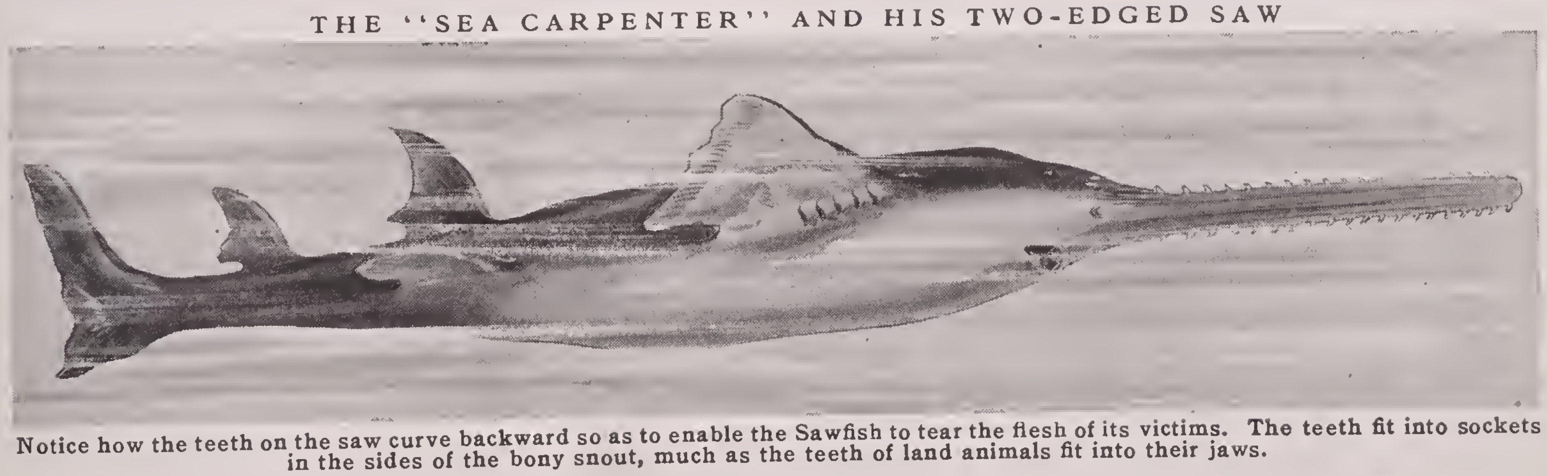
Many tales are told of sawfish attacking boats or bathers; but these stories are for the most part untrue, and are due to confusion of this animal with the much bolder and fiercer swordfish. The sawfish fights usually for food alone, and will rarely assail a creature bigger than itself. They are found mostly in warmer seas, but will sometimes ascend rivers. Specimens have been taken from the lower Mississippi. Scientific name of the American sawfish, *Pristis pectinatus.* (*See* Fish; Swordfish.)

SAXIFRAGE. Unlike most of the spring wild flowers of the north, the saxifrage is found growing on exposed rocks and on dry hillsides. The thick scalloped leaves are gathered into a rounded tuft near the ground and the pretty white-petaled flowers are scattered in clusters on the tall, bare stem. The flowers are found from March until May. The saxifrage family includes about 160 species ranging from New Brunswick south to Georgia and into the far west.

Scientific name of the early saxifrage, *Saxifraga virginiensis.* Flowers white, small, numerous, spreading into a loose panicle; calyx 5-lobed; 5 petaled; 10 stamens; 1 pistil with 2 styles. Stem 4 to 10 inches high, naked, sticky, hairy. Leaves clustered at base, thick, obovate. Fruit purplish-brown pods.

SAXONY, GERMANY. Much of the best of Germany is to be found in the former kingdom—now republic—of Saxony, which lies in the south on both sides of the navigable Elbe River, separated only by the picturesque Erzgebirge ("Ore Mountains") from the former Austrian province of Bohemia. Its people are easy-going and kindly; the capital, Dresden, is one of the chief centers of German art; the second city, Leipzig,

THE "SEA CARPENTER" AND HIS TWO-EDGED SAW



Notice how the teeth on the saw curve backward so as to enable the Sawfish to tear the flesh of its victims. The teeth fit into sockets in the sides of the bony snout, much as the teeth of land animals fit into their jaws.

is world famous for its university, its conservatory of music, and its chemical and printing industries; in and about Chemnitz are some of the greatest textile and other manufactures of Germany; while Meissen manufactures the beautiful "Dresden" porcelain and china wares. The fertile soil of Saxony supports a flourishing agriculture; its Merino sheep supply the famous "Saxony" wool; its rich mines produce coal, iron, tin, lead, silver, copper, zinc, nickel, and cobalt; its water power is abundant; and the people highly intelligent and well educated.

Although only three-fourths the size of New Jersey, Saxony has nearly twice the inhabitants of that commonwealth (about 4,671,000), making it the third German state in population, though ranking only fifth in area. As befits a land which was closely associated with Luther, over 90 per cent of the people are Protestants.

Started Out as Pirates

When the old Saxons first appear in history, they were redoubtable sea-pirates, ravaging the coasts of Britain and France from their homes at the base of the peninsula of Denmark. Beginning about 450 A.D., they helped to found the Anglo-Saxon kingdom of England (*see* England).

In Charlemagne's day the parent stock still dwelt by the shores of the North Sea, from the Elbe westward to near the Rhine, and from the sea southward to the low mountains of Hesse and Thuringia. Thirty years of almost incessant warfare (772–803) were required to conquer and christianize this vigorous people and make them a part of the Frankish empire (*see* Charlemagne).

Within little over a century afterward the duke of the Saxons had become king of all Germany, and revived the Holy Roman Empire (*see* Otto, Emperors of the Holy Roman Empire). And even after the kingship and imperial power had passed to other German lines, the rulers of the stem duchy of Saxony—especially Henry the Proud and his son, Henry the Lion (died 1195), who also ruled Bavaria—were among the most formidable of German princes.

Modern Saxony Has Moved

But modern Saxony has nothing but the name in common with the old stem duchy. Its very location is different, for it lies at least 150 miles to the southeast, in a "mark" or border-land conquered by the former dukes from the Slavic Wends. After 1423 this territory and the Saxon vote in the imperial electoral college belonged to the princely house of Wettin. In 1485 the land was partitioned between two sons, from whom descended an "Ernestine" line with Wittenberg as capital and the title of elector, and an "Albertine" line, with its capital at Leipzig.

The Elector Frederick the Wise (1486–1532), who was Luther's sovereign and protector, was the head of the Ernestine line. In 1547 his successor was defeated by Duke Maurice, head of the Albertine line, who thereby obtained the title of elector together with Wittenberg and other portions of Ernestine territory. Today the Ernestine line is represented by a group of petty states known as the "Saxon duchies," lying in the Thuringian region to the west of the Albertine lands.

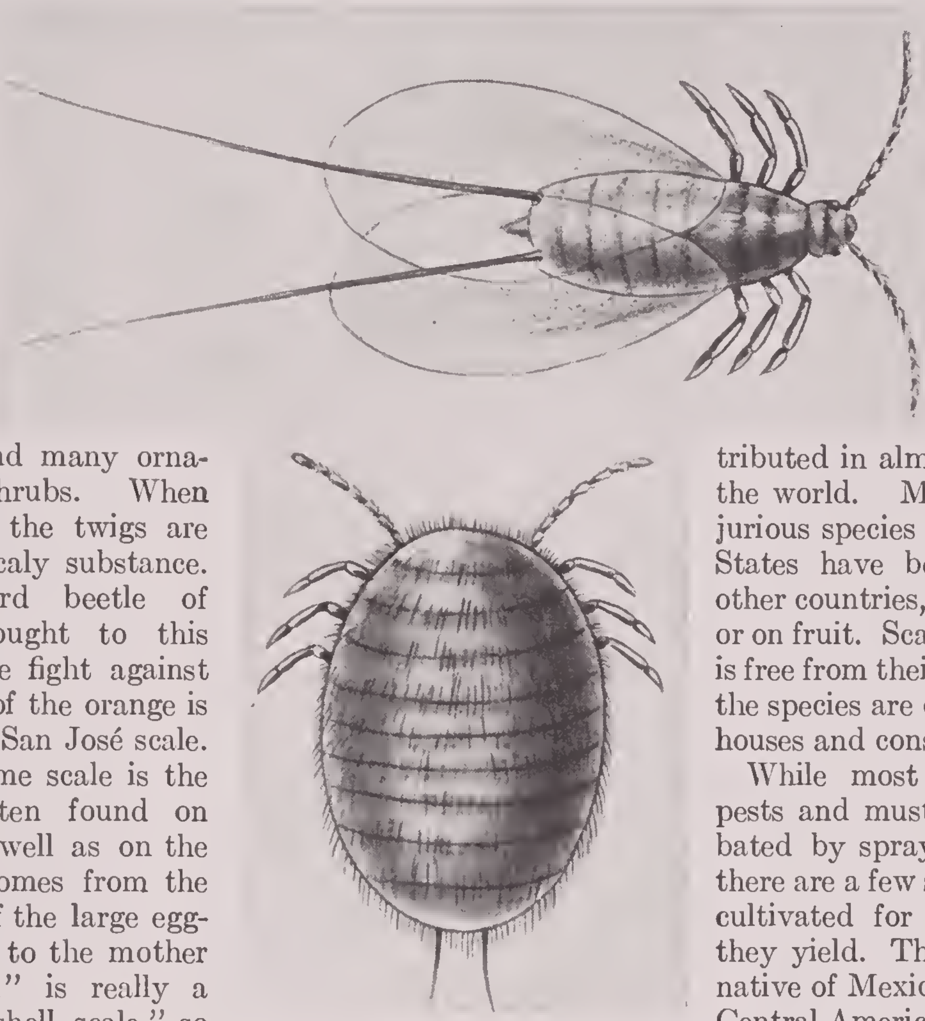
From the latter comes our present-day Saxony. It was devastated in the Thirty Years' War, but for nearly 70 years (1697–1763) its head was also (by election) king of Poland. It suffered severely at the ruthless hands of its Prussian neighbor, Frederick the Great. It was raised to a kingdom and had its territory increased by Napoleon; and then was deprived of its northern half, to the gain of Prussia, in 1815. It was again obliged to pay an indemnity to Prussia in 1866, for siding with Austria in the war of that year. But Saxony fought on the side of Prussia in the Franco-Prussian War and became a part of the new German Empire in 1871. With the rest of Germany it deposed its hereditary rulers and became a republic following the armistice of Nov. 11, 1918. (*See* Germany.)

SCALE INSECTS. Some years ago the fruit growers of California were thrown into a panic by the discovery that immense numbers of scale insects of the "cottony-cushion" species were devastating their trees, threatening the flourishing groves of citrus fruits with destruction. Spraying the thousands of acres of trees with insecticides seemed in those days a hopeless task, and ruin stared them in the face. Experts dispatched to Australia, whence the pest had accidentally been introduced, brought back with them the little red-and-black spotted Australian lady-bug, which they found was the natural enemy of this pest in its native land. When these imported beetles had multiplied sufficiently, numbers of them were sent to the fruit-growers, who liberated them in the groves. Swooping down on the feast, the beetles made quick work of the pest. By the aid of those beetles and other remedial measures, in less than two years the pest was so thoroughly controlled that although more than 30 years have since elapsed, it has never again got out of hand. A curious fact in this instance is that the imported lady-bugs, when deprived of their natural food supply, seemed unable to adapt themselves to other foods, and they also have become practically extinct in California.

The cottony-cushion scale (*Icerya purchasi*) is only one of a number of species of the group of scale insects which are very injurious to fruit trees, shade and ornamental trees, bushes, vines, and even grasses. They may occur on any part of the stem or leaves, and sometimes even on the roots. They are called "scale insects" because they fasten themselves to a certain spot on the plant, and, with their beaks buried in the tissues of the plant, there remain feeding on the sap, protected and concealed beneath a powdery, cottony, or waxy secretion and various cast-off skins which form an oval or rounded scale.

The most troublesome scale insect in the United States is the "San José scale" (*Aspidiotus perniciosus*), which is believed to have been introduced into this country from China. By 1890 it had spread over the greater part of California and five years later was established in many parts of the United States. It is now found all over the United States, and has proved very destructive in the best fruit-growing regions. It does not bother citrus fruits, but attacks many other trees and plants, including the apple, cherry, rose, pear, currant, gooseberry, elm, chestnut, oak, walnut, and many ornamental trees and shrubs. When this pest is present the twigs are marked by a gray scaly substance. Recently a lady-bird beetle of China has been brought to this country to aid in the fight against it. The "red scale" of the orange is a close relative of the San José scale.

THEY HELP TO TURN THINGS RED

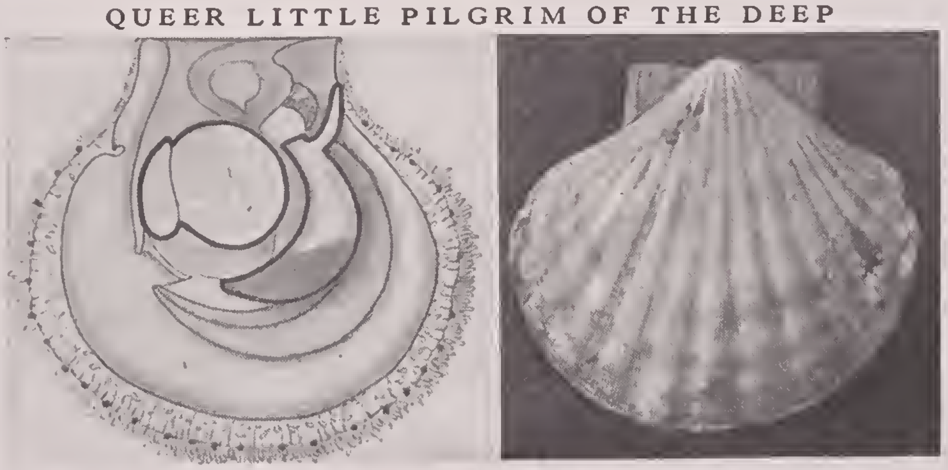


The upper picture shows the male Cochineal, the lower the female. From the dried bodies of these insects a famous red dye is made. The Cochineal is one of the few useful scale insects.

Another troublesome scale is the "cottony-maple," often found on many other trees as well as on the maple. Its name comes from the cottony appearance of the large egg-sac which is attached to the mother scale. The "cotton" is really a wax. The "oyster-shell scale," so named because the scale resembles the shell of some kinds of oysters, occurs frequently on apple, lilac, willow, and other trees.

These scale insects as a usual thing are stationary except for a few hours after hatching. The males possess legs and a single pair of wings; but the females lose their six legs after molting, and thenceforth are grublike, wingless, and stationary, and are concealed under the mass of cast-off skins and a powdery, cottony, or waxy secretion. When the young are hatched they leave the shelter, and rove about the food plant for a time in search of a suitable place in which to insert their beaks and begin pumping up the sap. A few species are called "mealy bugs" more often than "scales," as they move about more freely.

QUEER LITTLE PILGRIM OF THE DEEP



It was the shell of this little creature that the pilgrims of the Middle Ages used to wear in their hats. And it was indeed a proper symbol, for the Scallop himself is a sea traveler, pushing himself along by first sucking in and then squirting out water through his shell. On the left, the black lines indicate the delicious edible parts of this mollusk.

Often the scales go unnoticed on the bark until they have attained great numbers, and this, together with the ease with which these insects and their eggs, when attached to living plants, can be transported long distances, has caused many species that infest cultivated plants to become distributed in almost every country in the world. Most of the highly injurious species found in the United States have been introduced from other countries, either on young trees or on fruit. Scarcely any kind of tree is free from their attacks. Certain of the species are constant pests in hothouses and conservatories.

While most of the species are pests and must be constantly combated by spraying, fumigation, etc., there are a few scale insects that are cultivated for the useful products they yield. The cochineal insect, a native of Mexico and other parts of Central America, has long been used for making a red dye (*see* Cochineal), and in Europe and Asia there are a few species of the scale insect which have been used for a similar purpose for centuries past. The lac-insect of far Eastern countries exudes a resinous substance, which when dried, pounded, washed, and purified, becomes "lump-lac" or "shellac." (*See* Lacquer-Ware.)

SCALLOP. Most "bivalves" soon settle down for life, but the scallop is a pilgrim. He does not fasten himself to rocks or timbers, or form beds on the bottom of the ocean as do oysters, but is constantly roaming from place to place. He moves by sucking water into his shell and then squirting it out suddenly with sufficient force to push himself forward in funny little zigzag leaps. The extensive journeying of the scallop made the shell a fitting emblem for pilgrims, who in the Middle Ages wore it in their hats to indicate that they had taken long voyages by sea. It was especially the emblem of those who had made the pilgrimage to the shrine of St. James at Compostela (Spain).

There are numerous species of scallops found along the Atlantic coast of America, the chief of these being the common scallop (*Pecten irradians*) and the larger and handsomer-shelled northern scallop (*Pecten islandicus*), which is sometimes four or five inches across—more than twice the size of the common scallop. The latter has a considerably arched shell, with long deep grooves radiating from the center of the hinge which connects the two halves, like the ribs of a fan. The valves of the northern scallop shell are very much flattened and without ridges. Altogether there are about 200 living species, and many fossil ones.

The tender morsels sold in fish markets under the name of "scallops" are merely the bits of muscle with which these mollusks open and close their shells—the "adductor muscle," as it is called. This is the only part of the scallop that is eaten. Scallop shells are often used as dishes for baking and serving creamed fish. (*See also* Mollusks.)

SCANDINA'VIA. As a geographical designation the name Scandinavia is applied to Denmark, Sweden, and Norway, the region occupied by the latter two being called the Scandinavian Peninsula. The people of the Scandinavian countries are closely related in blood, language, and history, as well as geographical situation. They belong to the Low German branch of the Teutonic race, and are thus akin to the Angles, Saxons, and Jutes, who formed so important an element in the parent stock of the English people.

The Scandinavian people have spread beyond the limits of their homelands, colonizing Iceland, which is now united with Denmark under the same king, and Greenland, which is a Danish colony. Elsewhere Scandinavian emigrants have become merged with the peoples of other nations, as in the case of the Northmen who settled in Normandy, England, and Russia, adopting the language and customs of the people of those countries. In recent times Scandinavian emigrants have come to the United States in large numbers, settling chiefly in Wisconsin, Minnesota, and other states of the Northwest and contributing an important and vital element to the varied racial structure of the country.

From about 850 on, Denmark, Sweden, and Norway existed as separate kingdoms; but from the Union of Kalmar (1397) until 1524 they enjoyed a united government. Denmark and Norway remained united until the Congress of Vienna in 1815. (*See* articles on the separate countries.)

The kinship of the Scandinavian peoples is evidenced by the similarity of their languages, which are still so much alike that Norwegians, Danes, and Swedes can understand one another fairly well. It was not until about 1000 A.D. that sufficient differences grew up in the parent Scandinavian tongue to constitute the three dialects which have developed into the Swedish, Norwegian, and Danish languages as they are spoken today.

The Scandinavians remained for a long time a people of action rather than a literary and artistic people. The sea was all about them, inviting them to seek fortune and adventure, while the stern and rugged land could not be conquered without a struggle. Scandinavian literature therefore begins rather late, and it is only within recent times that there have been Scandinavian writers who may be regarded as world figures.

Tales of Old Heroic Days

In the old Viking days, to be sure, tales were told and songs were sung of war and adventure, of gods and heroes, and some of these were later put into writing. Among the oldest important works that remain are the two collections known as the Eddas, of which the Elder or Poetic Edda dates probably from the 10th and 11th centuries, and the Younger, or Prose Edda, from about the 12th century. It is from the Eddas that we get our stories of Odin and Thor and the other gods of northern mythology. Besides the Eddas, there are many sagas—historical or legendary tales in prose, often interspersed with bits of poetry—first told by the sagaman or story-teller as he wandered from place to place.

The modern period in Scandinavian literature had its real beginning in the 18th century. The Danish-Norwegian dramatist Holberg (1684–1754), who has been called "the Molière of the North," and the Swedish romantic poet Tegner (1782–1846) were prominent figures in their own lands; but Hans Christian Andersen of Denmark (1805–1875), the wonderful teller of fairy tales, was the first to be adopted by the whole world (*see* Andersen).

A Series of Great Writers

As Andersen showed what the world of fairyland was like, so other great Scandinavian writers, in the latter part of the 19th century, portrayed the world of reality and delved into the problems of life. To this period belong the Norwegian Björnson, the great and much-loved novelist and dramatist, and Ibsen, who was not only the greatest of Scandinavian dramatists, but in his own day probably the most influential writer in the whole world (*see* Björnson; Ibsen). Their contemporary Strindberg, the Swedish novelist and dramatist, possessed powers in some respects as great as theirs, but his work was marred by his bitter and unhealthy pessimism. Selma Lagerlöf of Sweden, through her stories, brought about a return to the world of imagination and romance (*see* Lagerlöf). But Andersen Nexö of Denmark, who pictured the peasant life of his own country with great power and fine understanding in 'Pelle the Conqueror', as well as Johan Bojer and Knut Hamsun of Norway, who use more somber colors, have turned again to realistic studies of life as it is.

The Apples of Iduna—A Myth of Scandinavia

"Iduna had a magic casket filled with wonderful apples, which the Fates had once allowed her to pluck from the Tree of Life. These had the marvelous power of giving immortal youth and loveliness to all who partook of them. And no matter how many she took from her casket, it was always full when next she opened it."

BEHIND the stormy seas which shut in the home-land of the Northmen were many great mountains, gloomy forests, glittering lakes, and foaming waterfalls. The winters there were long and cold and dark. The sun hung low in the sky and shone for only a few brief hours in the day. Every waterway was frozen and the land was buried deep in snow.

Then summer came—short, but bright and beautiful. When the snow and ice melted in the spring, and the land grew green under the warm rays of the returning sun, it seemed to those old Northmen that some evil spell had been broken. For they thought that the icy winter was caused by a triumph of the giants of Jotunheim over the gods of heaven.

In the shining city of Asgard where the gods dwelt there was a palace for wise Odin, king of the gods, and Frigga, his queen; for mighty Thor, the god of thunder, whose magic hammer was ever ready to smite the giants; for Balder the Beautiful, the smiling god of sun and summer; and for all the others of the great gods and goddesses of northern mythology, and there, too, was the great banqueting hall called Valhalla, to which the battle-maidens or Valkyrs led the spirits of warriors who on earth died a heroic death.

Among those dwellers in shining Asgard also were Bragi, the god of poetry and eloquence, and his sweet young wife, Iduna. She was the goddess of youth, the "ever young." In the light of her warm sunny smile no one could grow old. The trees in her garden were always just bursting into bloom, the birds singing and building their nests, and the dew sparkling on the grass.

Best of all, Iduna had a magic casket filled with wonderful apples, which the Fates had once allowed her to pluck from the Tree of Life. These had the marvelous power of giving immortal youth and loveliness to all who partook of them. And no matter how many she took from her casket, it was always full when next she opened it. It was these magic apples, distributed at the feasts of the gods, that enabled them to ward off disease and old age, and kept them always vigorous, beautiful, and young throughout the ages. You can imagine how bitterly the dwarfs and giants, who had no such magic food, longed for the apples of Iduna.

Now it happened that one day Loki, the mischief-making god, fell into the power of the terrible storm giant Thiassi; and to gain his freedom he promised that he would help Thiassi steal Iduna and her wonderful apples away from Asgard.

Loki waited until Bragi was gone to earth on one of his minstrel tours. Then he sought out Iduna who was left alone, and persuaded her to go with him to a grove near Asgard, where he falsely declared he had found a tree full of apples even finer than those she treasured. In order to compare the new apples with the old, Iduna foolishly took along her magic casket with its precious contents.

The Big Eagle and the Bitter Wind

Instantly, as they came out from the walls of Asgard, a bitter wind blew upon them. The sky was darkened with what seemed the wings of an enormous eagle, but which was really the storm giant Thiassi. Swooping down, he seized poor Iduna in his terrible claws, and bore her with her precious casket of apples far away to the frozen land of the giants.

All Asgard was alarmed when Iduna disappeared. Slowly the trees in her garden turned red and gold and brown, and gusty winds blew the faded and withered leaves from the limbs. The birds grew silent and at last flew away. Snow lay deep on all the streets and groves of Asgard. The gods and heroes sat over roaring fires in their palaces and tried to keep up their spirits with loud songs and brave stories. But without Iduna's apples they grew old and gray and tired. Even the wind sighed and moaned. The sun paled and dwindled and sank so low that it nearly fell off the rim of the world.

At length Bragi found out that it was Loki who had lured Iduna out of Asgard. All the gods and heroes were so angry with that mischief-maker that he promised to do what he could to undo the harm he had so idly wrought.

Borrowing Freya's falcon plumage, he flew off into the bitter North. Loki found Iduna imprisoned in a rocky cave by a frozen sea. She had refused to give the giant Thiassi a single bite of her apples, and this was her punishment.

Changing her by his magic into a trembling swallow, Loki set out bravely on the return, clutching Iduna and her apples tightly in his falcon claws. But the storm giant Thiassi, returning from a fishing expedition, unluckily beheld them, and was soon in swift pursuit on his mighty eagle pinions.

And That was the End of the Giant!

All the gods and heroes were on the walls of Asgard as pursued and pursuer drew near. Their hearts stood still when they saw the giant eagle so close to Loki and Iduna, in their forms of falcon and swallow. Hastily they prepared a mighty fire on the walls. Loki and Iduna at last cleared the wall and sank exhausted in Asgard. Then the fire of straw and kindlings flashed up with a mighty flame, singeing and blinding the pursuing giant. He fell within the walls and was promptly killed.

Restored to her right form, Iduna gave the gods to eat of her magic apples, and they at once grew youthful again. The grass sprang up, the trees turned green, the birds came back and sang, and flower buds opened to the mounting sun. Then the goddess leaned over the wall of Asgard and looked down with pity on the cold white earth below, which also lay in the bonds of winter. That too turned green and blossomed under her glance. Men in the fields, women in their dooryards, and children at play looked up at the blue sky and said to one another: "Iduna has come back to her garden. The earth is young again. The whole world has eaten of her magic apples, and spring is here."

SCHELDT (*skĕlt*) **RIVER.** This historic little river rises in France, flows north through Belgium past Ghent and Antwerp, and enters the North Sea at Flushing. It is 250 miles long and is navigable for 207 miles. The Dutch, who possess both banks of the river at its mouth, long claimed the exclusive navigation of the lower Scheldt (French *Escault*), and demanded toll of all foreign vessels sailing upon it. In 1839, in the treaty by which Holland consented to the separation of Belgium, this right was expressly confirmed. In 1863, to free the trade of Antwerp from this intolerable burden, Belgium bought off Holland's right for over three million dollars, each of the foreign powers trading to Antwerp paying a portion of this sum. In the peace negotiations at Paris, in 1919, Belgium went a step further and asked the surrender to her of the small strip of Dutch territory which lay on the river's south bank, but this request was refused.

SCHENECTADY (*skĕ-nĕk'tȧ-dĭ*), N. Y. It was electricity that put Schenectady "on the map," industrially speaking, for the General Electric Company, now the largest electric plant in the world, with branches in many other cities, had its beginnings and now has its headquarters in this city at the eastern end of the beautiful Mohawk valley, on the Mohawk River and the New York State Barge Canal. The inducement of cheap electric power has attracted many other industries, the second largest establishment being the American Locomotive Company, which also ranks among the world's industrial giants. "Schenectady lights and hauls the world" is a local slogan. All its growing industries employ a highly skilled and highly paid grade of labor, and the city boasts of its freedom from labor troubles.

Schenectady was once the little frontier village of Corlaer, remembered for the terrible massacre of its inhabitants by French and Indians in 1690, during King William's War. Immediately rebuilt, it became the port of entry and departure of produce and supplies by the canoes of the Inland Lock and Navigation Company, the forerunner of the Erie Canal. The bed of the old Erie Canal has now been made into the city's show thoroughfare.

Schenectady has a large park system, pure water electrically pumped from artesian wells, and an exceptionally low death rate. Union College, now expanded into Union University, was founded in 1795, being the second college incorporated in the state. Between 1900 and 1920 the population increased 180 per cent. Present population, about 90,000.

SCHILLER (*shĭl'ẽr*), **JOHANN CHRISTOPH FRIEDRICH** (1759–1805). Ten years before the birth of Napoleon, the great German poet and champion of freedom was born in the duchy of Württemberg, in southwestern Germany. When Friedrich Schiller was a very little boy and studied with Pastor Moser, he made up his mind to be a preacher. He often played church, and would stand on a chair and preach to a congregation composed of his parents and sisters. But when little Fritz was eight years old his father moved to the capital where the duke lived. Here was a theater to which Fritz was often admitted as a reward for industry, and he became so fond of it that instead of playing church he began playing theater with his sisters. When the duke established a school called the Karlschule at Castle Solitude, young Schiller as a bright pupil was invited to enter it. The Karlschule was very much like a military academy. At first Schiller studied law, but later he was allowed to study his father's profession, medicine. Here he remained until he was 21, when he was appointed as surgeon to one of the duke's regiments.

While Friedrich Schiller was at the Karlschule he wrote his first play, 'The Robbers'. He wrote it in secret, frequently pretending to be sick in order to find time for writing. Every publisher to whom he applied refused it, and he finally borrowed money and had the play printed at his own expense. It was received with great enthusiasm. 'The Robbers' deals with two brothers, Karl and Franz. Franz, the younger brother, is jealous of the elder, and succeeds in duping his unsuspecting father and brother by means of forged letters in which he shows each to the other in a false bad light. Karl is disgusted with the wickedness and injustice of society, and, like Robin Hood, he becomes a leader of a band of outlaws, who avenge the oppressed. He says, "Place me at the head of an army of fellows like myself, and Germany shall become a republic in comparison with which Rome and Sparta were nunneries." Throughout the play is heard the cry for liberty. In the end Karl discovers that his attempts to right wrongs by committing new wrongs, to enforce the laws by lawlessness, and to correct violence by violence, are nothing but criminal folly.

'The Robbers' was played for the first time in Mannheim, in January 1782, and Schiller secretly left his regiment in Stuttgart in order to see the production. The duke became very angry, both on account of the republican ideas expressed in the play, and because of Schiller's departure from Stuttgart without leave. He punished the young poet with arrest, and forbade him to "write comedies or anything of that sort." But Schiller soon made his escape and fled from Württemberg in company with a friend.

For the next seven years Schiller struggled along, writing several plays and receiving small compensation for his literary products. But he was gradually attaining renown. Then a friend introduced him to the young Duke of Weimar, to whom he read part of one of his plays. The duke showed his pleasure by making Schiller one of his councilors. This position later led to his appointment as professor of history at Jena University in 1789. With the little income he now received he was enabled, in 1790, to marry Charlotte von Lengefeld, a sweet lovable young woman. Soon after he formed an intimate friendship with Goethe and in 1799 he removed to Weimar, partly in order to be near Goethe, who was director of the theater in Weimar. This was the greatest and most productive period of Schiller's life, but his health was gradually failing. In 1805 he died in Weimar, one of the best loved poets of Germany.

The two best known plays of Schiller are 'The Maid of Orleans' and 'William Tell', both of them plays of patriotism. The heroine of the first is the French peasant girl, Joan of Arc, who leads the French troops in battle and frees her country from the English invaders. In 'William Tell', which was the last play that Schiller wrote and the most popular, the story deals with the struggle of the Swiss Forest Cantons against the tyranny of their Hapsburg governors. A passionate zeal for freedom pervades the play. Schiller never visited Switzerland, but this play has been declared by critics to portray faithfully the Swiss character, scenery, and folk-lore.

Schiller was also the author of many famous ballads and lyrics which are enjoyed by all who read German. His fame belongs to the period before Germany was corrupted by Prussianism, so it shines even fresher today that it did before the German Revolution.

Schiller's chief plays were: 'The Robbers' (1781); 'Don Carlos' (1787); 'Wallenstein' (1799); 'Mary Stuart' (1800); 'The Maid of Orleans' (1801); 'The Bride of Messina' (1803); 'William Tell' (1804). His collected works, in German, numbered 15 volumes.

SCHLIEMANN (*shlē'män*), **HEINRICH** (1822–1890). It is almost a century since a little boy in the small German town of Neubuckow in Mecklenburg sat on his father's knee listening to the wonderful tale of Troy and the great heroes who had fought there. But this ancient and glorious city, his father told him, had been so completely destroyed that not a trace of it remained.

When little Heinrich Schliemann was old enough to read the story himself, he pondered over his father's words, as he gazed at a picture of Troy in flames. At last he said: "Father, if the walls were really so strong and thick, something must be left of them. Some day I shall go to Troy and find the buried city." Many years later he carried out this resolve, and not only showed the world that Troy had actually existed, but revealed many long-hidden pages in the history of civilization.

Before he became a world-famous archaeologist, Schliemann had to pass through many hardships and struggles, yet he never forgot his dream of rediscovering Troy. It was in his thoughts when, as a grocer's apprentice, he was dealing out herring and butter or running errands. He remembered it when as a cabin boy he sailed for Venezuela, and when, after a wreck, he was employed as clerk in an office in Amsterdam. In the meantime he managed to learn several foreign languages.

At last prosperity came to him. He engaged in the indigo trade and acquired such a fortune that at the age of 36 he was able to retire and devote himself to his long-cherished dream. In 1870 he set out at the head of a large body of laborers for the desolate region about Hissarlik in Asia Minor, which he had long believed and now proved to be the site of ancient Troy. Even more rich and interesting than he had expected were the remains he found here. After devoting several years to this work, he crossed over to the mainland of Greece and excavated the prehistoric cities of Mycenae and Tiryns, bringing to light the splendid remains of a vanished civilization of 3,000 years and more ago (*see* Aegean Civilization).

It is an interesting fact that while traveling around the world, Schliemann happened to be in California in 1850 when that territory was made a state of the union, and under the law he became a citizen of the United States. Always afterwards he took great pride in this citizenship, and it was as an American that he made his great discoveries.

The SCHOOLS of the WORLD and Their Work

"Show Your Hands!" Morning Inspection in a Big New York School

SCHOOL. Every civilized nation realizes that there are no more important institutions in the world today than schools. There was a time when governments left it to parents to decide whether or not children should go to school, but that time has passed away in all foremost nations. In France, England, the United States, and Canada stricter and stricter laws are being enacted compelling parents to send their children to school, lengthening the school year, and making it easier and easier for every child to go to school by furnishing free more and more of the things needed, such as textbooks, notebooks, lunches, and the like.

It has taken centuries to bring nations to a realization of the soundness of the idea that educational opportunities should be universal and free. Germany was the first and Great Britain was among the last of all the great world powers to undertake to provide a system of universal schools. In the United States the public school systems in the most advanced states begin with the kindergarten and end with the university. All schools are open to all children. This has not been true in many other countries. England, France, and Germany long maintained what were practically two systems of schools—one system for the upper classes, which led to the universities, and another for the children of the working classes, which the pupils completed at about the age of 14 and which did not lead to the university.

The table on page 3140 shows the most important classes of schools, the ages of the pupils attending them, and some of the representatives of each class in the United States, England, France, and Germany. A glance at it shows that the same name is used in different countries to designate very different kinds of schools. A "high school" in the United States is a

A CHINESE SCHOOL OF OLDEN DAYS

These young Chinamen are starting for home with their school things under their arms, after making a ceremonious bow to the teacher. They are wearing queues, because the picture shows one of the old-time schools before the republic decreed the abolition of the "pigtail." In those days the Chinese boy spent years learning the ancient classics by heart, but education is now being rapidly reshaped to Western models.

secondary school. In Germany, a "high school" (*Hochschule*) is a technical school of university grade, corresponding for example to the Massachusetts Institute of Technology. Again, a "college" in the United States and England is an institution doing work of university grade, whereas in France a "college" is a secondary school. "Public school" in the United States is the name given to free schools open to all, supported by state and local taxation. In England, "public school" is the name given to the most expensive and aristocratic of all private schools. Indeed, conservative Englishmen of the old school insist that only nine of all the private schools in England have the right to call themselves "public schools." These nine include such schools as Eton, Charterhouse, Harrow, and Rugby.

Schools are commonly classed as elementary, secondary, and higher. A reference to the table on page 3140 will make sufficiently clear the meaning of these terms. There are many classes of schools in every land besides those named as representatives in that tabular list. The most important schools of the other classes are: (1) normal schools for training teachers; (2) reform schools for wayward boys and girls; (3) schools for different classes of defectives, such as schools for the blind, the deaf and dumb, and the feeble-minded; (4) rural schools; (5) summer schools; (6) commercial schools; (7) correspondence schools; (8) industrial schools; (9) continuation schools. All of the above classes of schools are to be found in every leading country today. The present account must confine itself to a brief consideration of the last six classes of schools as they are found in the United States.

The rural school is regarded by many thoughtful people as the most important as well as the most difficult problem in American education. About half of the people in the United States live in the country or in rural villages. This means that nearly half of the children in the United States go to one-room country schools. In nearly every state in the Union there are thousands of such schools, poorly housed, poorly equipped, taught by poorly paid and poorly prepared teachers. The defects in the rural school are largely due to the fact that in most states rural communities are divided for school purposes into small areas or school units known as districts. Each district desires to have its own school, but is too poor to maintain a good one.

Many movements are now on foot to improve the rural school. The most effective are the abolition of the school district as the school unit and making the township or county the unit. In some states we find county high schools and township high schools. In many states the law permits two or more districts to unite and establish what is known as a "consolidated school," in place of the several district schools. This results in building a good schoolhouse, providing it with excellent equipment, and employing well trained teachers. Busses are provided to carry the children free to and from school. In some states rural communities are erecting and furnishing pleasant homes for their teachers in order to make teaching in the country attractive. Minnesota is one of the foremost states in this respect. Such homes are commonly called "teacherages."

SCHOOLS OF MANY KINDS AND FOR MANY PURPOSES

Kind of School	*Age of Pupils in United States*	*Name in the United States*	*In England*	*In Germany*	*In France*
Infant	3 to 6	Kindergarten	Infant school	Kindergarten	Ecole maternelle
Elementary	6 to 14	Grade school	Public elementary school	Volkschule	Primary school
Secondary	14 to 18	High school, Junior high school, Academy	"Public school," Grammar school, Secondary school	Gymnasium, Realgymnasium, Oberrealschule	Lycée, Collége
Higher	18 to 22	Junior college, College, University	University	University, Hochschule (High school)	University

Vacation Schools

Vacation schools are the result of many different causes. The feeling that the summer vacation is longer than either pupils or teachers need, the fact that some pupils wish to shorten the time ordinarily required for completing a course of study, and that other pupils desire a chance to make up studies in which they have failed—these are a few of the many things that have led many colleges, universities, normal schools, secondary schools, and elementary schools to conduct summer sessions. It is doubtful whether there is a single university in the United States today of the first, second, or even of the third rank which does not conduct a summer session ranging from 6 to 12 weeks. Many of the larger cities have established summer sessions during which a certain number of the public schools, both elementary and secondary, are kept open. It is urged that children in the large cities are far better off in summer when in school part of each day than when spending the entire day running about the streets.

Commercial education, or definite preparation for business, is offered in numerous private commercial schools and colleges, in commercial departments of public high schools and of private secondary schools, and in departments or schools of commerce and business in private and state colleges and universities. The oldest commercial school of university grade in the United States is the Wharton School of Finance and Commerce established at the University of Pennsylvania in the year 1881. Another widely known school is the Amos Tuck School at Dartmouth College (Hanover, N. H.) established in 1900. Of the many other institutions of higher learning which have established schools or departments for commercial education mention may be made of the universities of California, Illinois, Michigan, Minnesota, Vermont, Wisconsin, the University of Chicago, and Harvard University. The school of commerce at Harvard is what is known as a graduate school. This means that one must be a college graduate before he will be admitted.

Correspondence schools differ from all ordinary types of schools in that the students instead of attending classes in the school building receive their instruction entirely by correspondence. Outlines of courses, lists of books to be read, directions and questions are mailed to the student, who writes out his lessons and returns them to the institution, where they are read and corrected and graded. The University Extension movement, which began in England in 1868, is regarded as the beginning of correspondence instruction. In America today correspondence schools exist by the hundreds. Many of the best universities maintain such schools or departments. The University of Chicago, Brown University, the universities of Wisconsin and Minnesota are only a few of a long list that might be named. The most widely known private institutions offering correspondence courses are the International Correspondence Schools of Scranton, Pa., and the Chautauqua Institution of Chautauqua, N.Y.

Industrial Schools

The term "industrial education" may be used to include all technical schools and colleges. Ordinarily, however, it is used to designate the vocational education designed to prepare manual workers in trades and industries. The United States and Canada have been much slower to provide industrial education than European countries. It has been argued that establishing trade and vocational schools will divide the children of the land into two groups, those preparing to become workers in trades and industries and those looking forward to occupations regarded as more genteel. It is urged that such a division within the schools will endanger democracy. In favor of trade and industrial training it is claimed that thousands of boys and girls leave school before they are 14 years of age, and go out into the world to earn their livelihood utterly unprepared to do anything but unskilled labor for the rest of their lives.

The rise of trade and industrial schools began with establishment of such schools by private individuals.

In time the different states attempted to make general laws providing for the establishment of such schools. On Feb. 23, 1917, the Congress of the United States passed a remarkable and most important law known as the Smith-Hughes law, providing Federal aid to the states for vocational education. This law created a Federal Board for Vocational Education, and provided a Federal appropriation on a graduated scale beginning with a total of $1,860,000 for the year 1917–18, and increasing year by year to a maximum of $7,360,000 for the year 1925–26. By the Smith-Hughes law this maximum will be continued indefinitely after the year 1926. In order to receive its share of the Smith-Hughes fund, a state must fulfil many conditions. The most important of these conditions is that the state must match dollar for dollar the amount it receives from the Federal government.

Continuation schools are schools established to provide training and instruction for people who are already engaged in employment. There has been a marked and increasing tendency both in Europe and America during recent years toward the establishment of such schools in larger communities, and toward the enacting of laws compelling employers and parents to send minors engaged in industry to continuation schools wherever such exist. In the United States the movement to establish continuation schools was led by Pennsylvania and Wisconsin. Wisconsin was the first state to pass a really effective compulsory continuation school law. Toward the close of the second decade of the 20th century this movement developed rapidly. Probably this was due to the influence of the Smith-Hughes law. In the two years 1918 to 1920 no less than 18 states passed such laws.

MANUAL TRAINING IN THE LAND OF SLOYD

Manual training is one of the many excellent features of the fine Swedish school systems. It was in Sweden that the system of manual training for younger children—the A B C of this excellent business—originated.

We cannot leave our discussion of schools without considering some of the problems connected with them. The most important problems in education today are: (1) the problem of the curriculum, or what ought the school to teach; (2) the problem of school support, or how much money is needed to support good schools and how shall this money be secured; (3) the problem of securing properly trained teachers. These three problems are all parts of one problem, namely, how shall educational opportunity be made free, universal, and equal.

TEACHING THE "BLACKFELLOWS" IN AUSTRALIA

In Australia the dark-skinned natives are known as "Blackfellows." Here is a group of these young savages in a school in North Queensland, learning that "Ned has a big bell in his hand" and that "Ben fell into the well," and many other interesting things; including, as you see, Numbers and Writing.

Many educational problems are due to the fact that there is no national school system in the United States. The control of education is one of the powers not specifically granted by the Constitution to the Federal government and which therefore by the Constitution itself belongs to the states. As a result of this and many other conditions, each of the 48 states has its own system of schools. These systems always include elementary and secondary schools, and in most states a state university as well. Public kindergartens, where found, are generally provided by cities voluntarily. There are, however, a number of states, notably California, which have attempted to make kindergartens a statewide institution.

Although the Federal government has established no national system of education, it has played an important part in the establishment of schools in nearly every state by giving princely endowments of land and money to help in the establishment of universities, colleges of agriculture and mechanical arts, and common schools. The land thus far given for common schools alone totals over 67.8 millions of acres. This is more than 31 times the area of England and more than seven times the area of France. Although the income derived from such Federal grants has frequently furnished a large fraction of the moneys spent on schools in states newly admitted to the Union, nevertheless as fast as states become thickly populated their schools come to depend more and more on state and local taxation. Taking the United States as a whole, we find that an overwhelming per cent of the moneys spent on schools comes from local taxes. About 77 per cent comes from the proceeds of local taxes; 15 per cent from state taxes; 3 per cent from endowments (generally though not always derived from grants given by the United States government); and about 5 per cent from other miscellaneous sources. The Federal government supports and directs education in Alaska and outlying possessions, but bears no relation to the schools of the states other than granting them financial assistance and furnishing them with information and advice. The fact that the commonest school unit is the small school district and that the largest part of school moneys in the United States comes from district taxes, and that while some districts are exceedingly rich others are exceedingly poor, results in great inequalities in the amount of money districts in the same state have for their schools. The consequence is that there is wide variation everywhere in the length of the school year, the kind of school buildings and equipment, the salaries paid to teachers, and the quality of the teaching.

The fact has been thoroughly established by decisions of the United States Supreme Court that every public school is a state, not a town, district, or city, institution. Nevertheless, in almost every state in the Union the schools are managed and financed as if they were local, not state, institutions. When the people of the United States really understand that the schools are truly state institutions, they will not be satisfied until every school is a good school, and then they will manage them and support them in such a manner that rapid progress will be made for evening out the inequalities of educational opportunity which are now found in every state. (*See* Colleges and Universities; Education; *also* Gary, Ind.; Kindergarten; Montessori Method; Universities.)

SCHOOL GARDENS. "A garden for every child and every child in a garden" was the motto of those interested in school gardens during American participation in the World War. And President Wilson said of the movement that it was "just as real and patriotic an effort as the building of ships or the firing of cannon." It is estimated that at least $15,000,000 a year was contributed to the food of the country from this source. School gardens have their place in peace also, owing to their important relation to several school studies.

First of these is nature study. There is no better way of bringing children into contact with plant life than by raising flowers and vegetables in the garden. The boys and girls get out of doors, prepare the soil, plant the seed, watch with great interest the growth of plants, cultivate them through the season, and finally observe the growth and ripening of the fruit. This whole cycle of growth and change is the most fundamental thing in plant study, and nothing can be

A SCHOOL GARDEN IN THE HEART OF A CITY

To look at this picture, you might think you were in a field away out in the country, mightn't you? But this is a garden conducted by the pupils of the Oakland School in the city of Chicago. In this garden they raise fine vegetables, of course, but what is much more important, the work and thought that goes into their gardening helps to raise fine boys and girls.

more interesting to children than this process when they themselves are concerned in the products.

In the second place, the garden has a very important place in the study of geography. In the home geography in the early grades, classes of children are required to visit the gardens and study the processes of cultivation and marketing the products. These are fundamental lessons in geography. In this way gardening leads on to agriculture, scientific farming, fruit raising, and the improvement of country life.

Perhaps the most important relation of the school garden is that to the home. Where boys and girls become properly interested in the school garden, they naturally desire to raise a garden at home in their own backyard and perhaps flower-beds and trees in the front yard. The whole town may take on a new appearance, in its yards and gardens, on account of this interest developed in the school garden.

The educative effect upon the boy or girl of carrying out through the whole season plans for cultivating a garden is one of the best products of good training. The cultivation of plants requires constant attention, forethought, intelligence, self-reliance, and a kind of originality; difficulties are to be met and overcome. Insects infest the plants and must be gotten rid of; chickens scratch up and spoil the garden and a fence is needed for protection; a dry spell calls for some plan of watering; weeds quickly take possession of a garden; and the child must be intelligent and thoughtful in meeting such difficulties. This is the best kind of training. To say the least, it is far better than letting the boy run wild on the streets to get into all sorts of mischief.

The value of the school gardens in education has long been recognized in Europe. They were started as early as 1819 in Schleswig-Holstein. In 1869 they were prescribed by law in Austria and Sweden, in Belgium since 1873, and in France since 1880. Many of the European governments and American cities and civic organizations subsidize the school gardens, offer prizes, and make training in agriculture obligatory for normal-school graduates.

It may be said in conclusion that school gardens have an important relation to the whole subject of industrial education. It is a phase of manual training to teach children to use the tools and implements of the garden, to prepare the soil and carefully cultivate plants. It is an outdoor physical training combined with intelligent mental effort quite equal in its effects to shop-work and in some ways superior.

SCHUBERT (*shṳ'bĕrt*), FRANZ PETER (1797–1828). "Whatever his eye beholds, whatever his hand touches, turns to music"—so another famous composer wrote of Schubert, the world's greatest songwriter. In his short life of only 31 years—a life of continual poverty—he produced more than 600 songs, many of them as simple in their beauty as folksongs, and others full of dramatic intensity, all poured forth from a heart filled to bursting with music.

The son of a poor schoolmaster in Vienna, Schubert showed his love for music at a very early age, and his family gave him what encouragement they could. Beginning at the tender age of five, his father taught him the violin, and an elder brother gave him lessons on the piano, until they could teach him nothing more. Little Franz—then aged seven—was sent to the choirmaster of the parish church; but he, too, after a few years found that he could teach his marvelous pupil little, and could only listen to him in wonder.

Then, when he was 11, Schubert's beautiful soprano voice secured him a place in the choir of the Austrian court chapel, and he began to receive training from the chief music school of Vienna. By the time he was 13 he had already begun to compose; his only difficulty was in obtaining enough music-paper so that he could write down his melodies.

Before he left the Vienna music school, at the age of 17, Schubert had composed a symphony. But though his friends recognized his genius, the publishers feared to accept the work of an unknown musician, and it was not until his 24th year that any of his works were printed. He supported himself as best he could by teaching. With his strength impaired by overwork, poverty, and disappointments, Schubert was unable to fight the illness which overtook him, and he died in his 32d year.

He wrote overtures, sonatas, symphonies, operas, cantatas—almost every sort of composition, in fact; but it is for his songs that Schubert is chiefly remembered and loved. He could scarcely read a poem without putting it to music. Goethe's poetry inspired a great many of his songs, among them the famous 'Erlking'. Among other favorites are several from Sir Walter Scott, and the beautiful Shakespearean songs, 'Hark! Hark! the Lark!' and 'Who is Sylvia?'

SCHUMANN, ROBERT (1810–1856). When, at the age of 20, Robert Schumann was making the great decision as to what should be his life work, he wrote to his mother, "My whole life has been a struggle between Poetry and Prose, or call it Music and Law." His father, a prosperous publisher in the German industrial town of Zwickau (in Saxony), had died, and his mother wished him to study law, as she thought it a more certain profession than music; but she yielded to her son's desire when she found that his whole soul was absorbed in music.

It was Schumann's ambition to become a great pianist; but while practicing according to a method which he himself had devised, he crippled one of the fingers of his right hand so badly that he was compelled to give up all hope of ever excelling in that line. In the end the world profited by his misfortune, for it led him to devote all his attention to composing, and as a composer he gained very high rank.

The romantic feeling which runs through most of Schumann's work is a reflection, in large measure, of the romance of his own life. He fell in love with Clara Wieck, daughter of his music teacher, who was a charming girl and a remarkable pianist. During the years when he was trying to win her, and in the year after she became his wife, Schumann composed some of his finest music, including many delightful compositions for the piano, three symphonies, and about 150 songs. Shortly afterward he wrote his great cantata, 'Paradise and the Peri', and began his music to Goethe's 'Faust'.

Schumann's life should have been very happy, but for a shadow cast over it by an inherited tendency to melancholia. His wife's tender care and sympathy helped him through several attacks, but finally in a fit of insanity he attempted to drown himself in the river Rhine. He was rescued but died a few months later in an asylum at Endenich, near Bonn, at the early age of 46.

Nevertheless, Schumann had a very great influence on the musical art of his time. For a number of years he edited a musical journal and through his criticism encouraged the best in music. He was among the first to recognize the great genius of Brahms, Chopin, Berlioz, and other rising composers.

The VAST *and* FASCINATING *Field of* SCIENCE

SCIENCE. When you were a little child you spent much of your time in learning facts about the things around you. You felt them with your fingers, your lips, your tongue; you tasted them, you listened to the sounds they made, you lifted them. In short, you used all your senses to find out as much as you could about them.

It was a very mixed-up lot of facts you learned. Sugar is good to eat, mother's silk dress is nice to touch, milk has a pleasant taste, the mug makes a bang when it is dropped; and many such facts you added to your store day by day.

Soon you began to sort these facts in your mind. Some of them belonged together: Dolly falls when you drop her, your spoon falls when it is knocked off the table; and a hundred other such facts were put together. So you came to the notion at last that all things fall when dropped. This for you was a beginning of science, for science grows in just this way. Men first observe facts, sort them, so as to put together those that seem related, and by thinking on these things reach broad truths that cover many facts.

As a child you went on in your belief that all things fall when dropped. Of course you did not state this law to yourself in any such way, but when you dropped a thing you looked for it on the floor, not on the ceiling. You acted on your belief. Then one day perhaps you had a toy balloon and you let go of it. That did not drop but went up. It may have been many months or even years before you found enough other facts of the same sort to help you understand that if a thing is lighter than air it does not usually drop, but rises instead. So you gradually added to your scientific knowledge.

How Science Grows

Now men have found out a great deal more about falling bodies than simply that they fall. They have watched them and timed them and measured how hard they hit and have put the facts together and thought about them until they have found out certain laws of falling bodies. They have found that the apple attracts the earth quite as well as the earth attracts the apple, and they know the laws of their mutual pull. And so science grows. Science is simply all the knowledge of fact that men have found out for sure and have put in order so they can use it to find the fixed order of things and the relations of cause and effect. These they call then the laws of nature.

This knowledge is now so great that no one mind can master all of science. A single great library may have on its shelves hundreds of thousands of books full of this scientific knowledge, so that you can easily find out about anything you may want to know.

The Many Divisions of Science

Science as a whole is broken up into many parts, each a science. Biology is the science that deals with living things. It in turn is divided into Botany, the science of plants, and Zoölogy, the science of animals. These are again divided. A man may devote his life to the study of birds and then not know all there is to be known about them. Ornithology is the science that deals with birds. Geology has to do with the history, structure, and changes of our earth. Physics deals with such forces as heat, light, and electricity, and with the stuff things are made of. The History of the races of men is a science, and so are Grammar and Geometry. Indeed, just to name all the sciences into which the great mass of knowledge is divided would take pages of print. (For a list of the sciences separately treated in these volumes, *see* the entry Science in Fact-Index.)

The results of scientific discovery are made use of in countless arts and professions, which are usually classified as Applied Science. Among these are Medicine, all forms of Engineering, Pedagogy, Agriculture, Navigation, etc.

But science has not only put in order a mass of knowledge; it has also shown that the scientific method of thinking is very important. This may be stated briefly as thinking to correct conclusions on a basis of tried and true facts.

An illustration will help to make this clear. When the people of the United States took Cuba years ago, they needed to clean up the island and make it healthful, for it had been a center of yellow fever which had been spread from Cuba to New Orleans, Philadelphia, Boston, and other ports by sailors or other travelers. Philadelphia in one year lost nearly one-third of its population by a plague of yellow fever. No one knew the cause of yellow fever or how it was spread. To fight it wisely these things had to be learned. So American doctors went to Cuba to get all the facts they could as to when it occurred, where, among what kinds of people, and so on. They found among other things that it was very common in swampy regions. That made them think that the germ of the disease might be carried by mosquitoes, as malaria was then known to be carried. The guess was worth testing. So mosquitoes in little cages were allowed to bite persons afflicted with the disease and, after several days, well persons. These were soldiers and doctors who offered themselves for the test. They one and all came down with the disease, and one, Dr. Lazear, died of it. Soldiers slept in swampy regions in shacks screened so no mosquitoes could get in and they did not take the disease even when they slept on beds in which persons had recently died of yellow fever. All these facts convinced the doctors that the mosquito carries the germ of yellow fever. (*see* Germ Theory of Disease; Mosquito.)

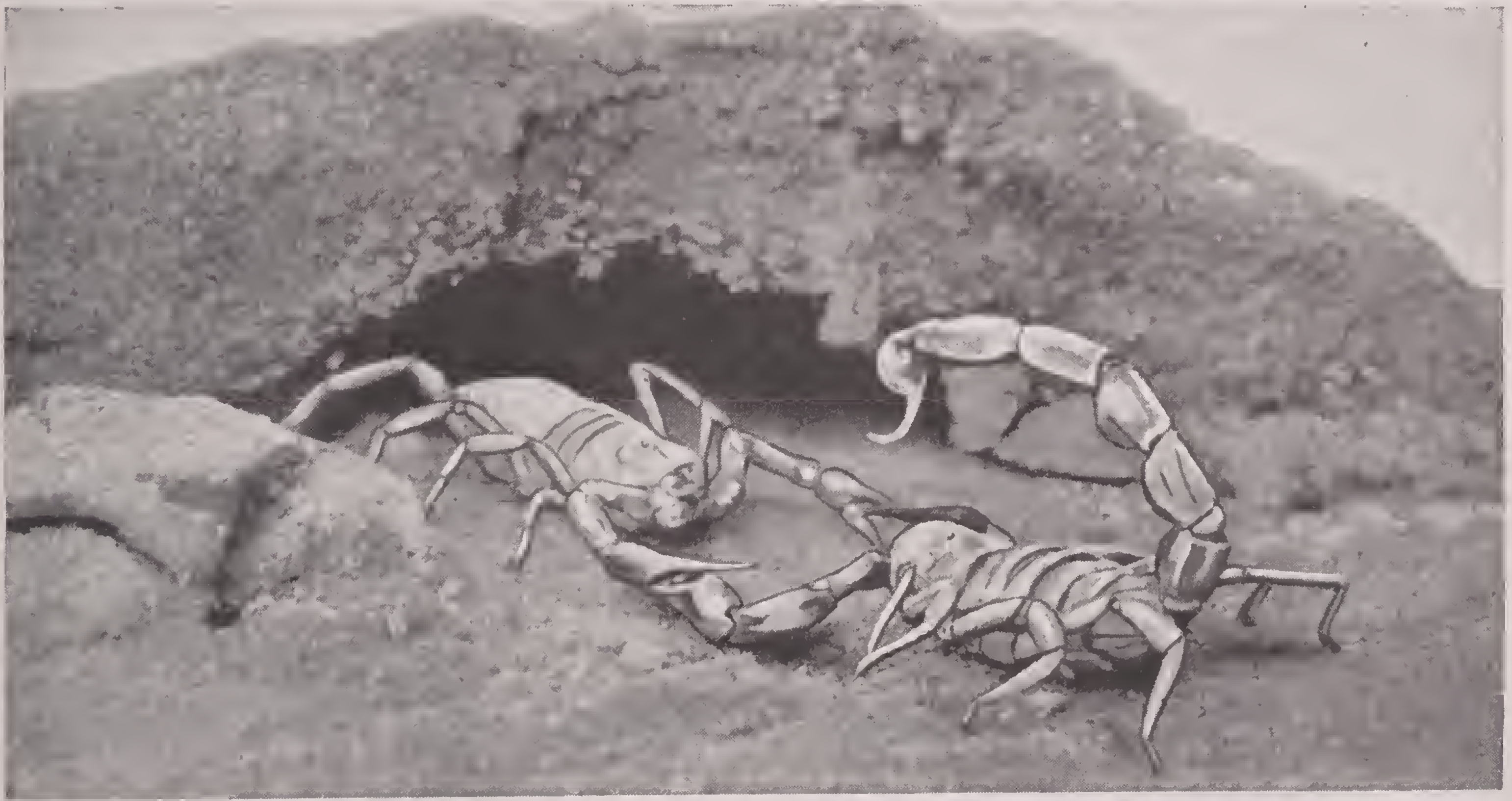
So this problem was solved by collecting facts, making a guess as to the solution, collecting more facts by experiment to test the guess, reasoning on all the facts to a correct judgment. Such is the scientific method. Scientists think all problems should be so settled, and not by whim, fancy, or prejudice.

SCORPION. Scorpions are near relatives of the spiders, for they too belong to the eight-legged *Arachnida.* But on account of their claws, they look much more like tiny lobsters or crawfish with very slender tails. At the end of that tail is the scorpion's chief distinction—his sting, a very hard sharp curved needle with a tiny hole near the tip through which he pours the poison stored in the last joint of his tail. When a scorpion has clutched its prey in its great powerful claws, it curves its tail over its head and plunges the paralyzing sting into the helpless creature.

Observers say that scorpions are most deliberate and careful in finding the right place in the captive's body to sting. Random thrusts might break the delicate sting against a beetle's tough armor, so they carefully feel for a soft place and then introduce the needle. The poison is sufficient to kill small creatures and to cause human beings much pain; it may even produce death in case a person is weak when he is stung. The scorpion is always careful to keep his formidable weapon out of harm's way by holding it aloft over his back.

Scorpions are found only in warm countries. They range from one to eight inches in length. Some small species are rather common in the southern portions of the United States. During the day most scorpions lie hidden under stones and logs, or in holes, and are rather slow and torpid. At night they come out and are very quick and active. Their food consists of small insects, spiders, lizards, toads, slugs, snails, and even small mammals such as mice and shrews. They are not vicious unless disturbed and seldom do harm to man. The mother scorpion brings forth her young alive and carries them about on her back for some days. Unlike insects, scorpions resemble their parents when born and undergo no "metamorphosis." Scorpions have lived for a long time on the earth, for fossil remains, differing but little from modern types, are found in rocks of ancient formation.

HOW SCORPIONS SAY "HOW DO YOU DO"



When two Scorpions meet—provided they are on friendly terms—they sometimes "shake hands" in a way that grotesquely suggests the handshake of human beings. But among the best families in Scorpionland, this is only part of the ceremony; for each curves its tail over its back, as one of them is already doing here, until their tails cross, when they hook their tips around each other.

The BONNIE HOMELAND of the SCOT

View across Loch Lomond—the Largest of the Famous Scottish Lakes

SCOTLAND. The northern third of the island of Britain, which for a thousand years has been known as Scotland, is divided geographically into three parts, the northern Highlands, the central Lowlands, and the southern Uplands. The northern Highlands average about 1,500 feet above the sea and are mostly heather-covered rocks where nothing can be grown. In the little valleys between the hills a few sheep are pastured. Much of the country is used today for hunting preserves, and is a country where the red deer can still be stalked and grouse shot. The Highlands of Scotland are really the holiday country of the wealthier English, and when Parliament adjourns on August 12 every year, the grouse hunting season opens in Scotland. The Lowlands represent fairly good farming country, where wheat, oats, barley, etc., are grown and where a considerable dairying business is carried on. The Scottish people are good farmers and know how to make economical use of their land. In few parts of Europe has farming improved so rapidly in the last century as in the Lowlands of Scotland. The southern Uplands are less fertile, and while various crops can be grown sheep-raising is the chief occupation.

This is a Scotch Highlander in typical Highland dress, with his plaid and his brooch, his kilt and his bonnet, saucily cocked on the side of his head.

The whole coast-line of Scotland is very irregular, and the western part fairly bristles with a fringe of "firths" (fiords) and peninsulas and islands. The Orkney and Shetland Islands to the north, and the Western Islands or Hebrides Islands are all parts of Scotland. The greater portion of the mainland is mountainous. The rugged Grampian Mountains (average height, 2,000 to 3,000 feet) separate the Highlands from the Lowlands and have at their western extremity Ben Nevis ("ben" means "mount"), Scotland's highest peak (4,406 feet). Southward are lesser peaks and groups, of which Ben Lomond (3,192), although not the highest, is the most famous. The Cheviot Hills (highest peak, 2,658 feet) lie on the southern border. Scotland is dotted with numerous lakes, of which beautiful Loch Lomond is the largest and most famous in story. Loch Ness and Loch Lochy, with their connecting waters, were joined in 1803 by canals with locks so as to make a continuous waterway (the Caledonian Canal) 62 miles long across northern Scotland, from Moray Firth, an arm of the North Sea, to the Firth of Lorne, which opens to the Atlantic. Vessels of 500 to 600 tons, usually fishing boats, pass through the canal, and it is a favorite route for tourists in the summer season. Scotland's total land area, including its 186 islands, is 29,797 square miles, and the population is about 5,000,000. (For map, *see* England.)

Seventy-five per cent of the population today is concentrated in a small district centering in Glasgow, the great factory city of the southwest and the largest city of Scotland (about 1,110,000 population). In that neighborhood are great coal mines that produce about 40,000,000 tons of coal a year, and in and around Glasgow great ship-building industries have grown up, the most important in the British Isles. Machinery, jute, linen, wool, etc., are also manufactured in this same neighborhood and elsewhere in

THE GIANT OF SCOTLAND'S MOUNTAINS

This is the famous Ben Nevis in Inverness-shire, Scotland. It is the highest mountain in the British Isles and if you should follow the bridle road up to the summit—it only takes two or three hours—you could see from there every good-sized mountain peak in the whole of Scotland. Ben Nevis is not only tall—4,406 feet above sea level, but burly—about 30 miles around. "Ben," by the way, isn't short for "Benjamin," it's Scotch for "mountain."

Scotland. As one travels southward from Glasgow, on the great Caledonian Railway, one rides for an hour past great massed factories, whose chimneys and smoke obscure the sky. Whiskey, preserves, and chemicals are important manufactures in addition to the textiles and iron and steel. Fishing also is one of Scotland's great industries. Besides Edinburgh (the capital, 320,000) and Glasgow, the chief cities are Dundee, Aberdeen, Paisley, Leith, and Greenock.

THE ROYAL CASTLE OF BALMORAL

Balmoral Castle, one of the residences of British royalty, is particularly associated with the name of Queen Victoria, as it was her favorite summer home.

The Scottish people have been handicapped in many ways. They have little good land, the rainfall over most of the country is so great as to interfere with agriculture, the arms of the sea and the mountains cut off the various parts of the country one from another. Few countries have conquered such natural disadvantages. The Scots have learned to make the most of what they have. They are an industrious, clever, and thrifty people, and not only build ships for other nations but man them. It is said that, in any part of the world, if you go below the hatchway to the engine room and call out, "Mac, are you there?" a Scottish engineer will poke up his head and answer.

It is also said that the road a Scotchman likes best is the highway down to London; and it has been true for a century—and is more true now than ever—that the best young talent in Scotland goes south to London, and that Scottish talent recruits English business and politics. The Scots have gone also—and continue to go—to the British colonies and to the United States, where they are nearly always successful.

Racially it is hard to distinguish the Scot from the northern English; they look alike and talk much alike, and have the same manners. Scottish skulls do not prove them to be very different in race. Probably the Scots more largely than the English are descended from the early peoples who spoke Celtic dialects, but they have some Saxon and Danish and more Norman ancestry than has sometimes been assumed.

Scotland's early history is a tangled web of tribal warfare and clan struggles, and has little of the uniformity of development and symmetry that belongs to English history. The Romans never conquered the Caledonians or Picts who inhabited this part of Britain. At the end of the 5th century a people called

MAJESTIC ARCHITECTURE NOT BUILT WITH HANDS

If you ever go to Scotland, you mustn't fail to visit the wonderful Fingal's Cave on the Island of Staffa, off the Scotch coast. The pillars you see were made by the cooling of an ancient stream of lava that ran out into the sea and made the island. The long arched cave (it runs back for 227 feet and rises into a vault 66 feet high) makes you feel as if you were looking into the underground cathedral of some creatures of the underworld. The play of color on the basalt walls brings out every tint of warm red, brown, and rich maroon, and the seaweeds and the lichens paint the walls in green and gold. You might imagine there was a pipe organ too in this cathedral, for always there comes from it the low, rich murmur of the sea, varied in times of storm by a sound as of thunder, as the air within, compressed by the force of the wind, rushes out again.

Scots came from Ireland and settled western Scotland and in the 9th century Picts and Scots united in a single kingdom under Kenneth MacAlpine, king of the Scots. When the Normans conquered England, the successors of William of Normandy made claims to feudal lordship over the kings of Scotland, but these claims remained vague. Richard Coeur de Lion sold his claim upon Scotland for money to go crusading. Edward I of England took advantage of the disputes between heirs to attempt to unite Scotland with England. His plan was statesmanlike but took no account of Scottish nationalism. Sir William Wallace resisted him at Stirling Bridge and became the great hero of Scotland. Wallace was, however, defeated at Falkirk (1298), and was finally captured and put to death. Robert the Bruce, grandson of one of the earlier claimants to the throne, renewed the war, and after many misadventures (*see* Bruce, Robert) was able at Bannockburn, in 1314, to drive the army of Edward II headlong into England. Scotland thus regained her independence, and in the wars which England fought with France in the 14th and 15th centuries (*see* Hundred Years' War) Scotland sided with France. There were many border battles, in most of which the Scots got the worst of it; Halidon Hill (1333) and Flodden Field (1513) are two of these battles most renowned in song and story.

Scotland under the lead of John Knox (*see* Knox, John) early adopted the Calvinistic or Presbyterian form of the Protestant Reformation; but Mary Queen of Scots remained a Roman Catholic and had a claim to the throne of England. She was driven out of Scotland into the hands of Elizabeth of England, who afterward allowed her to be executed (*see* Mary Stuart, Queen of Scots). Mary's son James VI was brought up in the Presbyterian faith. On Elizabeth's death he succeeded to the throne of England also as James I, uniting the crowns of the two nations but not the governments.

When Charles I, son and successor of James, attempted to impose upon Scotland the English episcopal form of government, a servant maid named Jenny Geddes threw a stool at the ritualistic bishop in St. Giles Church, Edinburgh, and so began the successful Scottish rebellion, or Bishops' Wars (1637). The advance of the victorious Scottish army onto

English soil made it possible for the Puritan party in England to maintain the rights of the English Parliament against Charles I. Eventually the Scottish army and the army of Parliament joined hands in war against Charles (1642). When Charles was forced to throw himself into the hands of the Scots after the battle of Naseby (1645) they turned him over to the English. His execution in 1649, however, produced a reaction in Scotland and his eldest son was welcomed in Edinburgh as Charles II. Cromwell marched into Scotland, defeated the Scottish at Dunbar (1651), drove Charles II out, and governed Scotland as a conquered nation. The restoration of Charles II in 1660 gave Scotland again separate government. The overthrow of the last Stuart king, James II, in 1688–89, was disapproved in the Highlands, and for a century afterward there were adherents of the fallen Stuarts in that part of the country. Twice, in 1715 and 1745, there were formidable "Jacobite" uprisings.

The Act of Union in 1707 brought Scotland and England under one government. "There are few instances on record," says a wise English historian, "in which a nation passed in so short a time from a state of barbarism to a state of civilization." Barbarism is probably too strong a word, but the Scots up to that time had lacked much of that law and order and peace which had become characteristic of the English kingdom. An admirable elementary and secondary school system—superior to that of England—has been established, while the Scottish universities of Edinburgh, St. Andrews, Glasgow, and Aberdeen hold high rank the world over.

In the 19th century Scotland underwent a great industrial change. Coal and steam, railways and machinery, made Scotland over. The Scots were a people who took to machinery and the large-scale business that followed machinery. Scotland became more important than it had ever been before. Its population increased. Queen Victoria's preference for her northern realm as a summer residence was much appreciated in that country. More and more the politicians of Scotland found careers in the Parliament at Westminster, and the past 50 years of British history give color to the Scottish saying, when they are twitted about dependency, that they "rule England." While the Scots today love to recall Sir William Wallace and Robert the Bruce, it is because of their feeling for the past rather than from any national feeling against union with England. The poetry of Robert Burns and the romances of Sir Walter Scott have given the Scots a new pride in their country and raised the esteem for Scotland all over the world, and in such matters as local government, their national church (Presbyterian), and national law, they are as completely self-governing as they could desire.

It is a curious fact that a people as talented as the Scots have produced so few poets, musicians, painters, and sculptors. In a general way they seem to be a practical people, more interested in business and politics than in artistic activity. Yet they have been a nation of theologians and metaphysicians; the visitor to Edinburgh finds the statues of their great theologians on every corner. It has been said that every Scotchman is a philosopher. Knowledge and reading are more widely diffused in Scotland than in any other part of the British Isles, and Edinburgh and Glasgow are the home of great bookshops. The average Scotchman knows the lore of his country, and its border ballads; but he is at the same time a good Britisher.

Scott, Robert Falcon (1868–1912). On the 29th of March, 1912, three dying men lay in a little tent in the frozen Antarctic continent—three heroic men who had been to the South Pole. On their way back they had been caught by a terrible blizzard within 11 miles of a depot in which food and fuel awaited them. While the fearful gale beat and howled outside the flimsy shelter, their commander raised himself in his sleeping bag and feebly wrote these words: "We shall stick it out to the end, but we are getting weaker of course and the end cannot be far. It seems a pity but I cannot write any more.—R. Scott." Some time later he added the last entry, "For God's sake look after our people."

So ended in tragedy the English exploring expedition under Capt. Robert F. Scott which had gone out two years before with such high hopes. They had reached the South Pole, indeed, on Jan. 18, but not first. For Roald Amundsen, the Norwegian explorer, had arrived there on Dec. 16, 1911, a month earlier.

The story of the desperate struggle to cover the 1,800 miles from the Pole back to their base, as told in Captain Scott's diary, is one of the most heroic and pathetic narratives in history. Soon after leaving the Pole one of the party succumbed to the hardships.

ROBERT FALCON SCOTT

This photograph of the heroic explorer was taken on the ill-fated expedition which cost him his life.

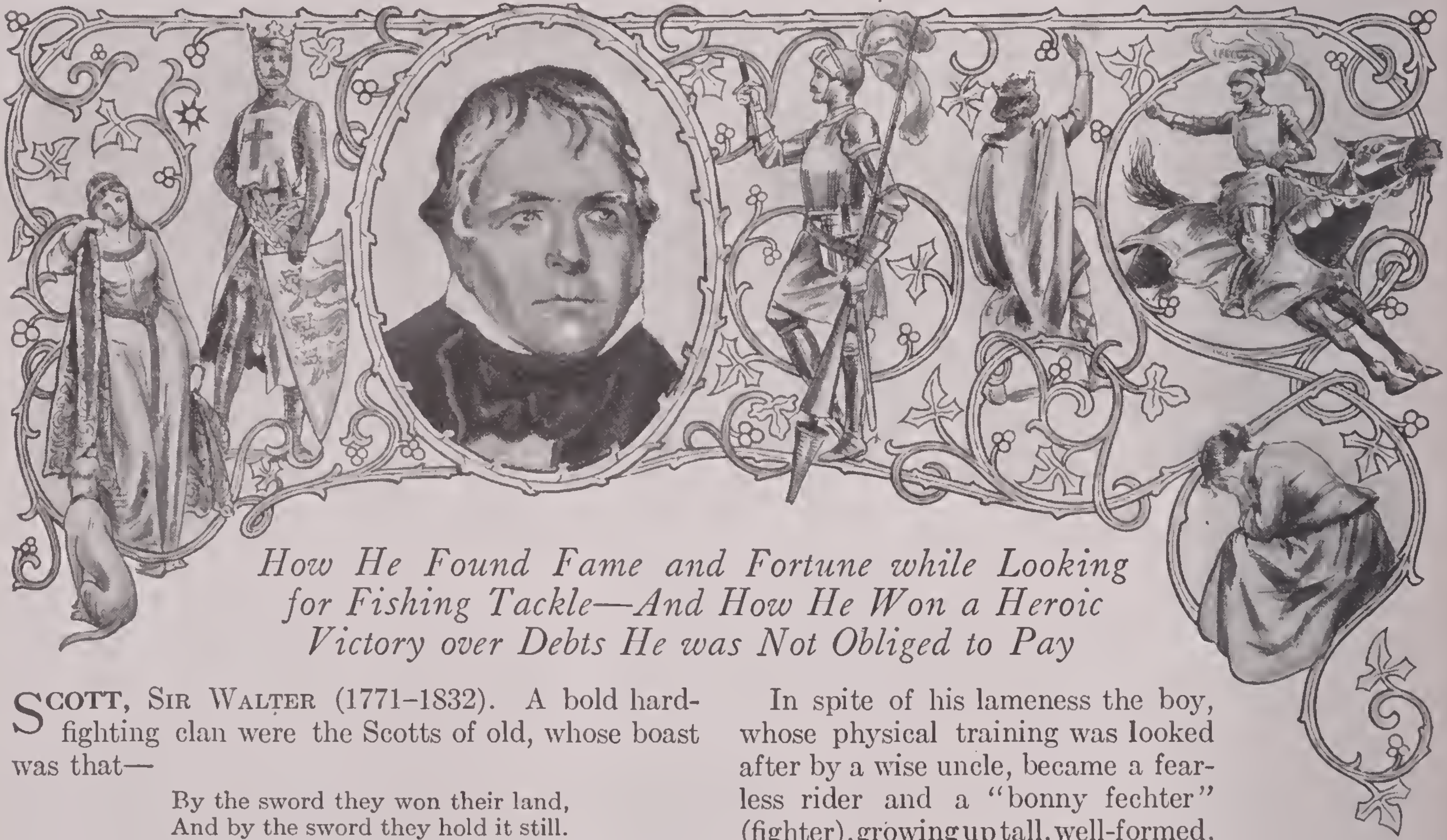
Then gallant Capt. Lawrence Oates became disabled. He could go no farther, and it was death for his comrades to stay with him. So bidding them goodby, he calmly walked out into the raging blinding blizzard to meet his death.

Even this sacrifice was in vain. When the survivors at last knew that the end was near, Captain Scott wrote his imperishable farewell to England, in which he said: "I do not regret this journey, which has shown that Englishmen can endure hardships, help one another, and meet death with as great fortitude as ever in the past. We have been willing to give our lives for this enterprise, which is for the honor of our country."

And to his wife he wrote: "Make our boy interested in natural history if you can. It is better than games. Keep him in the open air. Above all, you must guard him from indolence. Make him a strenuous man. The great God has called me. Take comfort in that I die in peace with the world and myself and am not afraid."

Scott entered the English navy at 14 as a cadet. In 1901 he headed an expedition to the Antarctic in the *Discovery* which discovered King Edward VII Land and did notable scientific research work. His second and last expedition started in 1910 in the *Terra Nova*. It also accomplished much valuable research work. Captain Scott's records were recovered when his body was found eight months after his death. There in the everlasting snows a cairn has been raised and a cross surmounts the last resting place of these gallant martyrs of science. (*See* Polar Explorations.)

The LAME BOY *Who Became* A GREAT STORY WRITER



How He Found Fame and Fortune while Looking for Fishing Tackle—And How He Won a Heroic Victory over Debts He was Not Obliged to Pay

SCOTT, Sir Walter (1771–1832). A bold hard-fighting clan were the Scotts of old, whose boast was that—

> By the sword they won their land,
> And by the sword they hold it still.

What would "auld Watt of Harden" (Scott's ancestor) have said if he could have known that the greatest glory of his line would be the lame son of an Edinburgh lawyer?

"Auld Watt's" illustrious namesake was kin as well to many other historic Scotch families, and the "old tales" of Scottish history that he heard "by the winter's hearth" in childhood were often tales of his own forefathers. If an early illness that we know today as infantile paralysis had not left him lame from the age of 18 months, Walter Scott might have continued the traditions of his race in deeds, not words. Perhaps the Duke of Wellington would have had another gallant officer at Waterloo, and we should have had no 'Marmion' and no Waverley novels.

In spite of his lameness the boy, whose physical training was looked after by a wise uncle, became a fearless rider and a "bonny fechter" (fighter), growing up tall, well-formed, and extraordinarily strong and active—"wayward, bold, and wild," as he himself wrote. In school he was a meteor, now at the bottom of the class and now at the top, already a lover of old things and old ways, a Tory through affection for the past, a weaver of romances, noted for a capacious memory, which, however, retained only what appealed to him and absolutely rejected what did not.

In his 15th year he was apprenticed to his father's profession of law, and practiced it without enthusiasm for a number of years. The publication in 1802 of the first two volumes of his 'Minstrelsy of the Scottish Border', for which he had been collecting material ever since his early college days, unmistakably indicated his true vocation. The 'Minstrelsy' showed the hand of the poet, the romancer, and the living antiquary; it was an immediate success.

Meanwhile Scott, at the suggestion of young Lady Dalkeith (afterward Duchess of Buccleuch), had undertaken a poem based on the legend of a goblin page. The Duke of Buccleuch was the head of the house of Scott, and thus, out of the poet's desire to do honor to his friend and feudal chief, grew 'The Lay of the Last Minstrel', which, both in story and in setting, embodies so much family tradition. The poem was published in 1805, and took the public by storm. The meter was new; the wild tales of the Scottish border had never before been used as literary material; the combination was magical. The enthusiasm of the public took the very satisfactory form of readiness to buy the book and the sales were, for the time, enormous—far beyond those of any poem hitherto published.

Scott now resolved to make literature "his staff, not his crutch." His serious business became the editing of stately rows on rows of works of other authors; but as a relaxation he began 'Marmion', which was published in 1808, and became even more popular than the 'Lay of the Last Minstrel'. Its stirring lines "took possession of the public like a kind of madness"; people could not help spouting them in solitary places and muttering them as they walked about the streets. In 1810 appeared 'The Lady of the Lake', which made Ellen's Isle and Loch Katrine fashionable sights for tourists.

How Byron's Poetry Drove Scott to Fame

Meanwhile Scott's private affairs had reached a crisis which was to have an effect on his literary life. In 1797 he had married Miss Charlotte Charpentier, the daughter of a refugee French royalist, and now had several children. Ever an outdoor man, he inclined to the life of a country squire. In 1812 he purchased a small run-down estate on the Tweed, near Melrose, which he named Abbotsford, and on the enlargement and beautification of which he optimistically spent his large earnings before they were at hand. In 1813 his publishers, the Ballantynes, whose partner Scott had become a few years before, were on the verge of bankruptcy, which was only narrowly averted. Two new poems ('Rokeby', 1813, and the 'Lord of the Isles', 1814) were received with enthusiasm, but their sales showed a waning popularity; in fact, they were not equal to their predecessors, and, besides, Byron's 'Childe Harold', which appeared in 1812, had monopolized literary attention.

During this period of gathering cloud, Scott, searching for some fishing tackle, came across a manuscript of his which contained the first chapters of a prose romance, begun and laid aside in 1805. He resolved to complete it. Thus 'Waverley' came to be published in 1814—but anonymously. It not only surpassed the success of the poems, but wrought a literary revolution, bringing in the fashion of the historical romance. Then followed 'The Antiquary', 'Old Mortality', 'Rob Roy', 'The Heart of Midlothian', and others of the famous Waverley series, in rapid succession. Never did fortune seem to smile more kindly on any man. Though Scott still published his novels anonymously, the authorship was an open secret. Wealth, fame, and honors were heaped upon him; in 1820 he was knighted. In addition to the two or three novels a year he kept pouring out, Scott was also publishing scores of essays and other works under his own name, and carrying on a voluminous correspondence. Yet, the most hospitable of country squires, he seemed to be the idlest of men and entirely at the disposal of his swarms of guests. None but a few intimate friends knew how early he got up in the morning to dash off a chapter or two before breakfast, or that he had a torturing stomach disorder which had been brought on by this furious overwork.

The Dark Days and Field of Honor

In 1826, Scott's publisher failed, and Scott became personally responsible for £130,000 (about $650,000). Against the dark days that followed, the heroic elements in Scott's character stand out as they never could in prosperity. He refused to become a bankrupt—a step which would have permitted him to retain the use of his own earnings—but set furiously to work to pay his creditors in full. "I will be their vassal for life," he said, "and dig in the mine of my imagination to find diamonds . . . to make good my engagements, not to enrich myself." His wife died; he was stricken first with rheumatism and then with paralysis. Still he struggled bravely on to complete a task greater than he knew. His debts were in the end paid in full, but only after his death, which was the direct result of his immense exertions.

When his physicians recommended a sea voyage for his health, a government vessel was placed at his disposal. For almost a year he cruised about in the Mediterranean. But when he felt that his end was near, he insisted on being taken home to his beloved Abbotsford, and there he died on Sept. 21, 1832. He was buried in Dryburgh Abbey.

Scott set slight store by literary reputation (he did not publicly acknowledge the authorship of the novels until 1827), and perhaps it meant more to him that he left the stainless name of a chivalrous and kindly gentleman than that he was known as the prince of romancers, at the hearth of whose genius "three generations have warmed their hands."

Scott may be called the creator of the historical novel, and in this field he has not been surpassed. He is not always strictly accurate, but he has that magic power, which only a great creative genius can possess, of making the characters and events of the past vividly and thrillingly alive.

Among Scott's chief works are the long narrative poems: 'The Lay of the Last Minstrel' (1805), 'Marmion' (1808), and 'The Lady of the Lake' (1810); and his novels 'Waverley' (1814); 'Guy Mannering' (1815); 'Rob Roy' (1817); 'The Heart of Midlothian' (1818); 'Ivanhoe' (1820); 'Kenilworth' (1821); 'Quentin Durward' (1823); 'The Talisman' (1825); and 'Woodstock' (1826).

The Tournament of Ashby

A SEA of waving plumes and shining helmets, forests of tall gleaming lances, clusters of pavilions magnificent with their scarlet, green, and gold, long tapestried galleries thronged with gaily decked nobles, knights, and ladies, together with an eager crowd of commoner folk—this was the view that met the gaze of treacherous Prince John of England as he rode into the great field at Ashby and took his place in the royal gallery, some 700 years ago. It was the day of the great tournament, when the most gallant and skilful knights of all the land were to contend with lance and sword for fame and the honor of their fair ladies.

At a signal from the prince the heralds proclaimed the laws of the tournament. Five renowned knights were challengers against all comers, to combat such knights as touched with their lances the challengers' shields, which hung before their pavilions. When a shield was touched with the point of a lance, the deadly combat with sharp weapons was to follow; when touched with a reversed lance, the safer "arms of courtesy"—lances tipped with a flat round board—were to be used. When each of the knights had broken five lances the prince was to select the first day's victor, who was to win not only a fine war horse, but the right to choose some fair maiden to be Queen of Love and Beauty and sit on a throne opposite to Prince John and award the next day's prize.

The Heralds Call Out the Knights

"Largesse!" cried the heralds, according to custom, after their proclamation. And amid a shower of gold and silver pieces they added, "Love of ladies—Death of champions—Honor to the generous—Glory to the brave!" With the field cleared for action, five knights, chosen by lot, advanced from the northern inclosure toward the tents of the challengers at the south. Martial music gave them a defiant welcome as each touched with a reversed lance his antagonist's shield, and retreated to the extremity of the field. Then as the challengers, headed by the renowned Brian de Bois-Guilbert, appeared in the lists, there was a flourish of trumpets. At full gallop the knights charged against one another. Shouts, cries, and clanging trumpets told a few moments later of the challengers' triumph and of the defeat of four of their opponents. Again and again various other parties of knights met a similar defeat from the triumphant five, who, strong and dextrous, never lost their seats, never swerved from their course. Brian de Bois-Guilbert, who with a single spear had overthrown two knights and foiled a third, now seemed to be the winner.

All at once a solitary trumpet sounded in the distance, and a stalwart graceful figure appeared, with helmet visor down, mounted on a gallant black charger and bearing the Spanish word *Desdichado* ("Disinherited") on his shield. Straight to the pavilion of Brian de Bois-Guilbert he went, rapped the shield smartly with the sharp end of his spear, then backed defiantly down the lists and stood waiting.

A trumpet signal, a dash, and the champions met with a thunderous shock, their horses recoiling, their lances shivering into splinters in their hands.

Shouts from excited spectators, a great waving of scarfs, a retreat for fresh lances, a moment's hush, and then another violent onset. This time the Disinherited reeled from the other's blow but remained on his steed; while his enemy, hit fair by the lance's point in the bars of his helmet, reeled also, then—as his saddle girths gave way—rolled to the ground, vanquished! One by one the unknown knight then encountered the four other challengers, and one by one triumphed over them.

As he advanced on foot to receive the splendid war horse which was the victor's prize, the Disinherited Knight refused to raise his visor and show his face. "Can it be Richard Coeur de Lion himself, escaped from Austria?" whispered a courtier to the prince, who blanched at the thought of his brother's return, and of the usurped power he must give up.

The Unknown Knight and His Lady

The Unknown accepted his prize with a bow and vaulted into the saddle without touching foot to stirrup. Then with a coronet of green satin hooped with gold upon his lance's point he paraded slowly around the lists, scanning the flushed and smiling faces of the fair ladies while the spectators in breathless silence awaited his choice for Queen of Love and Beauty. He paused at length beneath the balcony of Lady Rowena, a fair Saxon maiden who with far-off eyes was thinking of her vanished lover Ivanhoe, disinherited by his stern old father for friendship with the Norman conquerors, and who had accompanied Richard the Lion-Hearted to Palestine. Slowly the day's champion lowered his lance and laid the crown before her, Rowena, his chosen Queen!

The general tournament was held on the following day. Fifty knights on each side, the one party under the leadership of Brian de Bois-Guilbert, the other under the Disinherited Knight, took part in the combat, using sharp swords and pointed lances. The heralds proclaimed the rules: blows with the sword but not thrusts were allowed; maces and battle-axes were lawful but daggers were prohibited; unhorsed knights could fight only others that were unhorsed; a knight forced to the end of the lists was vanquished and his horse and armor were the prize of his conqueror; a knight struck down and unable to rise was vanquished and could be removed by his squire or page. A knight who broke the rules might be stript of his arms and, with shield reversed, set as an object of derision astride the palisade bars. The combat was to end when the prince threw down his truncheon.

What a fine sight the knights made as they arrayed themselves in lines opposite one another! Their plumes fluttered in the morning breeze, their steeds pawed the ground, and their hundred lances glistened in the sun. Then, "*Laissez aller!*" ("Let them go!") shouted the marshal and the foremost ranks dashed upon one another. There was a tremendous shock as the ranks met, and a confused sound of groans, shouts, and clanging blows. As the clouds of dust lifted, the spectators could see about half the knights now fighting furiously on foot, others stretched motionless on the ground, others still mounted and shouting their battle cries of "Ha! *Beau-seant!*" and "*Desdichado!*" as they vigorously swung sword or battle-ax. Above the tumult rose the voices of heralds: "Fight on, brave knights! Death is better than defeat. Man dies, but glory lives! Fight on—for bright eyes behold your deeds!"

The Furious Fight of the Leaders

As the leaders met, their eyes flashed with the hatred of rivalry, and a furious fight began. Suddenly two other strong knights bore down upon Bois-Guilbert's opponent. "Beware, Sir Disinherited!" cried out the spectators, and the treacherously attacked knight reined back his steed in the nick of time. For the next few moments, like a great swooping hawk, he kept all three of his enemies at his sword's point. He would have been overpowered, however, had not help come from an unexpected quarter. A powerful knight in black armor, who had done no active fighting, now dashed to his rescue and with mighty clanging blows felled two of the assailants. Then the Black Knight galloped back, leaving the Disinherited Knight alone with Bois-Guilbert, the leader of the opposing party, whom he quickly charged and struck to the ground.

At this moment the prince's truncheon fell, and the conflict was over. The Disinherited Knight, who had also overcome six champions with his own hands, in addition to Bois-Guilbert, was reluctantly named victor of the day by unworthy Prince John.

Amid thunderous applause the hero was escorted by the marshals to the throne of honor where beautiful Lady Rowena was waiting with the chaplet of victory. Despite his protests the marshals removed his helmet. At Rowena's feet knelt a handsome fair-haired young man of 25. The lady started back with a faint shriek. Then with enforced calm she placed the chaplet on the victor's head and said clearly: "I bestow on thee, Sir Knight, this meed of valor. Upon brow more worthy could wreath of chivalry never be placed!"

These last words were uttered with deep feeling, and no wonder! For the Disinherited Knight, stooping to kiss her hand, was none other than her long-lost lover—Ivanhoe.

Not until later did England learn that Ivanhoe's Black Champion, who had come so bravely to his rescue, was King Richard the Lion-Hearted himself, secretly returned to England to reclaim his throne from the treacherous brother to whose plots he owed his long detention in captivity while returning from the Holy Land.—*Retold from Scott's 'Ivanhoe'.*

SCOTT, GENERAL WINFIELD (1786–1866). "Old Fuss and Feathers" was the nickname the soldiers gave to Gen. Winfield Scott because he was such a lover of formalities. But in spite of this, Scott was for years the foremost soldier in the United States.

A Virginian by birth, Scott studied law at William and Mary College. But he practiced this profession for only two years. In 1808 he became a captain in the army, and gained fame in the War of 1812 and in the Mexican War. By the end of that first war he had been made a major-general because of his services in the battles of Chippewa and Lundy's Lane. In the second his victorious march from Vera Cruz to Mexico City made him a national hero. He was nominated for the presidency by the Whig party in 1852, but was defeated in the election. In 1855 the rank of lieutenant-general was given him by Congress.

Scott performed many other important services. At the close of the Black Hawk War he negotiated the treaties with the Indians. He removed the Seminoles from Florida and Georgia. In the so-called Aroostook War, when the settlers of Maine and New Brunswick quarreled over the boundary line, he was sent to preserve peace; and in a similar controversy in the Northwest over the occupation of the island of San Juan in Puget Sound he performed a like service.

When the Civil War broke out Scott was general-in-chief of the army. But he was now 75 years old, and a younger man was needed to meet the situation; so after planning for the defense of Washington he laid down his command in 1861.

SCRANTON, PA. Astride the Lackawanna River about eight miles above its junction with the Susquehanna, in northeastern Pennsylvania, stands Scranton, city of "black diamonds" and silk.

Scranton is the wealthiest coal mining city in the world, for it is the center of the chief anthracite district of the United States. Its 20,000,000 tons' annual production of coal helps to make it a great manufacturing city, producing locomotives, machinery, tools, pumps, boilers, bolts and nuts, other iron and steel products, pianos, knit goods, lace curtains, buttons, and silk. Scranton is one of the foremost silk-manufacturing cities of the country, making a very large part of the nation's raw silk. In fact, silk spinning is a favorite industry among the Pennsylvania anthracite cities, partly because of the cheap fuel, and partly because of the cheap mill labor afforded by the miners' wives and daughters.

Scranton also has the largest correspondence school in the world. It is a city of wide streets, fine public and office buildings, and extensive parks. Its citizens are especially proud of its unlimited pure water supply and its low death rate.

Although the locality was settled between 1788 and 1800, under the name of Slocum Hollow, it did not receive its present name until Col. George W. Scranton and his associates undertook its development about 1840. Today Scranton is the third city in Pennsylvania, with a population of about 140,000.

WONDER WORKERS *in* MARBLE *and* BRONZE

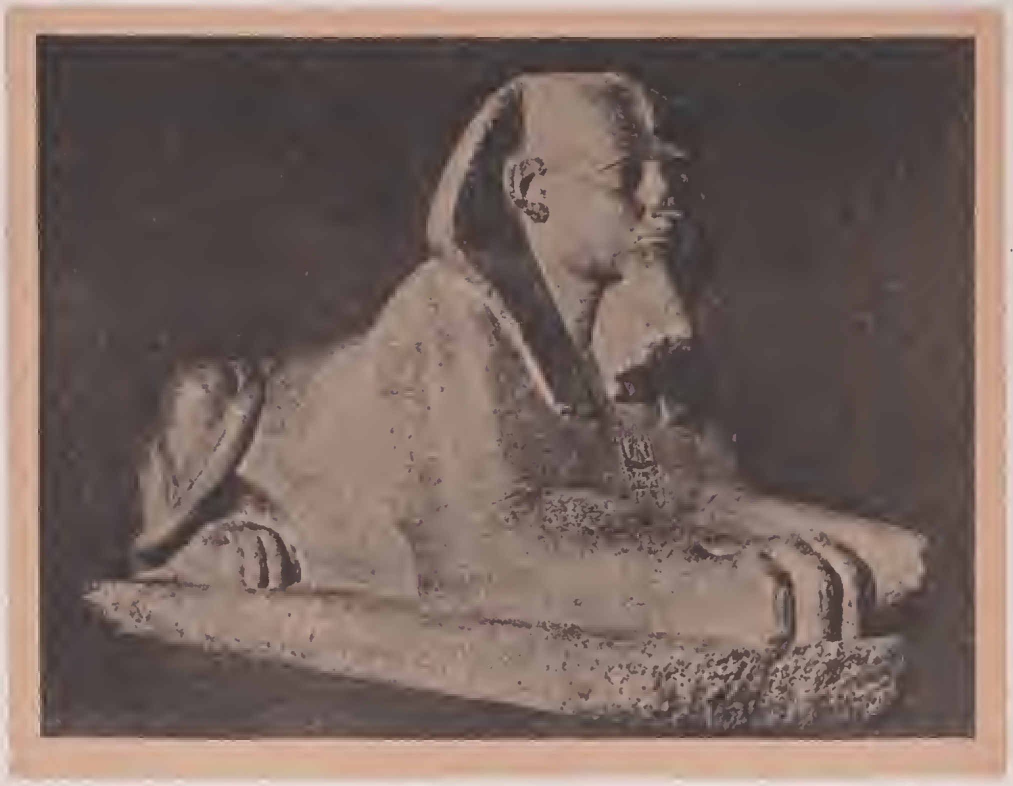
"HOW wonderful," exclaims Hawthorne, "to take a block of marble and convert it wholly into thought!" This is the miracle of the sculptor's art. As the painter speaks to us through line and color, so the sculptor reveals his message through beauty of form. He who has not learned to love sculpture and to read this message misses a whole world of beauty and truth. In the history of this great art, as we trace it from its first crude beginnings, we find the expression of the noblest thoughts and aspirations of the people among whom it has flourished.

SCULPTURE. Sculpture (the word comes from the Latin *sculpo*, meaning "to cut" or "to carve out") is the art of representing the form of an object by cutting, carving, or otherwise shaping a solid substance, such as stone or marble, clay, wood, ivory, or bronze. It is often called "the plastic art," from the Greek word meaning to shape or mold. Human figures or the forms of animals are generally represented. Some figures are so made that they may be seen entire, or from all sides. Such works are technically called sculptures "in the round." When the figures are attached to a background, they are said to be "in relief"—*alto-relievo* or "high relief," if they project far from the background, and *bas-relief*, or "low relief," if they project only a little. Sometimes the design, instead of being raised, is hollowed out below the surface. This is known as *intaglio*, and is used mainly in the carving of precious stones for jewelry.

In making a statue, the sculptor usually makes first a small model or sketch of wax or clay, to try the general effect. Then he makes a full-size figure of clay, using a sort of skeleton or framework of iron, if the figure be a large one, and modeling the damp clay with his fingers or with simple wooden, bone, or iron tools. When this is finished, it is covered with a mixture of plaster of Paris with water, which quickly sets, and when removed makes a hollow mold. The inside is brushed with some oily substance to prevent sticking; fresh plaster is poured in, and when it has set, the mold is removed, and a true cast appears. If the statue is to be of marble, this cast is copied exactly by a skilled workman, with the aid of a pointing machine, which measures off points on the block of marble corresponding to those on the model and thus indicates exactly where the workman is to cut. The artist himself usually puts the finishing touches upon the marble statue, although in some cases he does not touch the marble at all. Such is the method commonly used by the sculptors of today. Formerly, before mechanical devices were so perfected, the sculptor left less to his assistants. Michelangelo is one of the few sculptors who are known to have carved statues directly from the block of marble; sometimes he did not even make a small model to work from—such was his marvelous skill in hewing his great conceptions into form. Bronze statues are made by pouring melted bronze instead of plaster into the mold, a process of the greatest difficulty.

Sculpture is far more ancient than written history, and we have no record of its beginnings. Perhaps the same instinct which leads children to shape sand or clay into forms imitative of natural objects led primitive man to fashion his first rude works of sculpture. But it is not until some idea, some deeper spirit, enters into it that sculpture becomes a fine art. And that spirit, we have reason to believe, was first of all religious—the same spirit which in its rudest form led men to set up idols of wood or stone and worship them, and which in a higher form inspired the marvelous sculpture of the Greeks and the great works of after-times.

FROM THE EGYPT OF 4,000 YEARS AGO

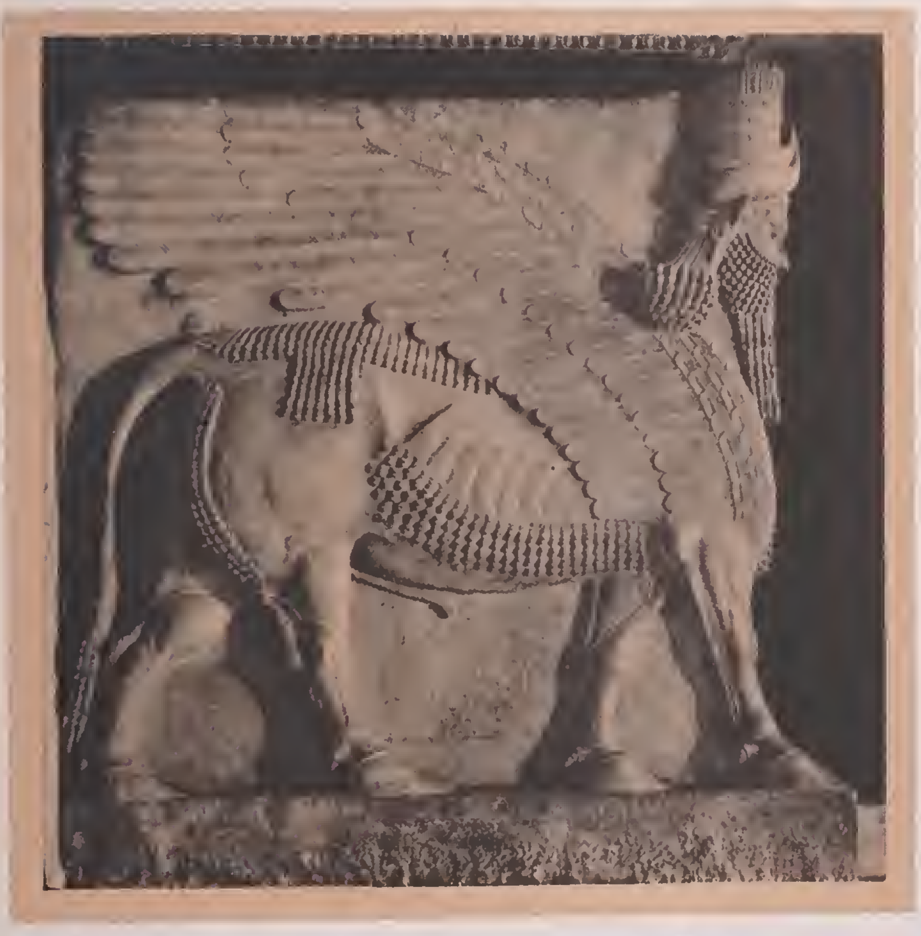


About 1800 B.C. some Egyptian Pharaoh had this Sphinx (now in the Louvre Museum in Paris) carved out of granite to immortalize his royal features. Egyptian sculpture, like Egyptian architecture, excelled in massive and monumental works conveying the impression of power and grandeur.

In Egypt, where we find remains of art even 7,000 years old, it was the belief in the immortality of the soul that chiefly inspired the sculptor. The preservation of the *ka* or spirit, it was believed, depended upon the preservation of the human body as a mummy, or failing that, of its representation in a sculptured portrait. Regarding the tomb as man's age-long dwelling place, they also gave much care to sculpturing reliefs upon its walls. Durability was the chief quality sought and attained by the Egyptians. In making statues of their Pharaohs, or rulers, they chose the hardest materials —basalt, diorite, and granite—that they might endure forever. And thanks to the dry air of Egypt, not only these but works in softer materials, such as sandstone, limestone, and even wood, have withstood the elements for thousands of years. The great Sphinx near the Pyramids of Gizeh (*see* Sphinx), and the colossal portrait statues of Amenhotep III at Thebes, still stand where they were hewn out of the massive rock. Many smaller statues may be seen in museums in Egypt and in other parts of the world. Although the faces are realistic portraits, these statues—especially after Egyptian art was conventionalized—appear stiff and lifeless to us. They all face squarely to the front, and a vertical line could be drawn through the nose, the center of the breast bone, and down to the ground.

The art of the Babylonians is almost as old as that of the Egyptians. They were especially fond of representing great muscular strength. The Assyrians and Chaldeans continued these traditions, and also showed great skill in depicting animals, such as the wonderfully lifelike wounded lion and lioness now preserved in the British Museum. They are famous, too, for the great winged man-headed

AN ASSYRIAN MAN-HEADED BULL



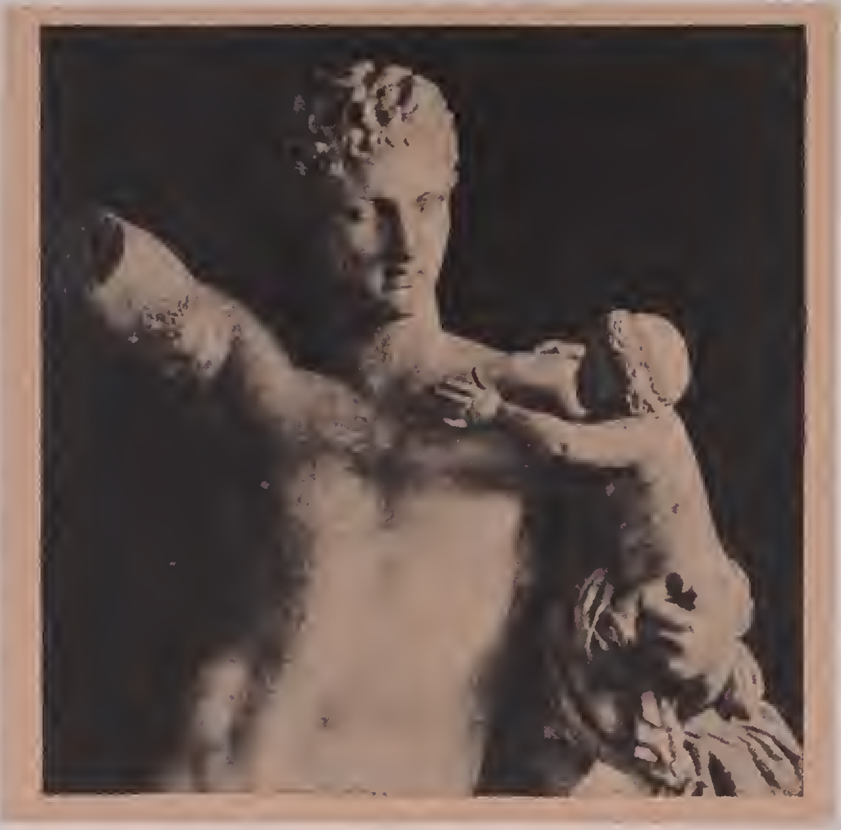
The Assyrian sculptors reached the summit of their achievement in their powerful and dramatic portrayal of animals. This colossal winged bull (in the British Museum) once guarded a doorway in the palace of Sargon, king of Assyria from 722 to 705 B.C.

bulls which they set to guard the entrances to their palaces. Notable, too, are the exquisite figures carved in ivory by the ancient inhabitants of Crete, whose wonderful attainments have only recently been revealed to us (*see* Aegean Civilization).

The Greeks learned much from these older peoples, but their early ("archaic") sculptures were crude to an amazing degree. Gradually, however, they developed a perfection in sculpture which had never been seen before, and in some respects has never been equaled since. The story of their art and that of the Romans who followed them is told elsewhere (*see* Greek and Roman Art).

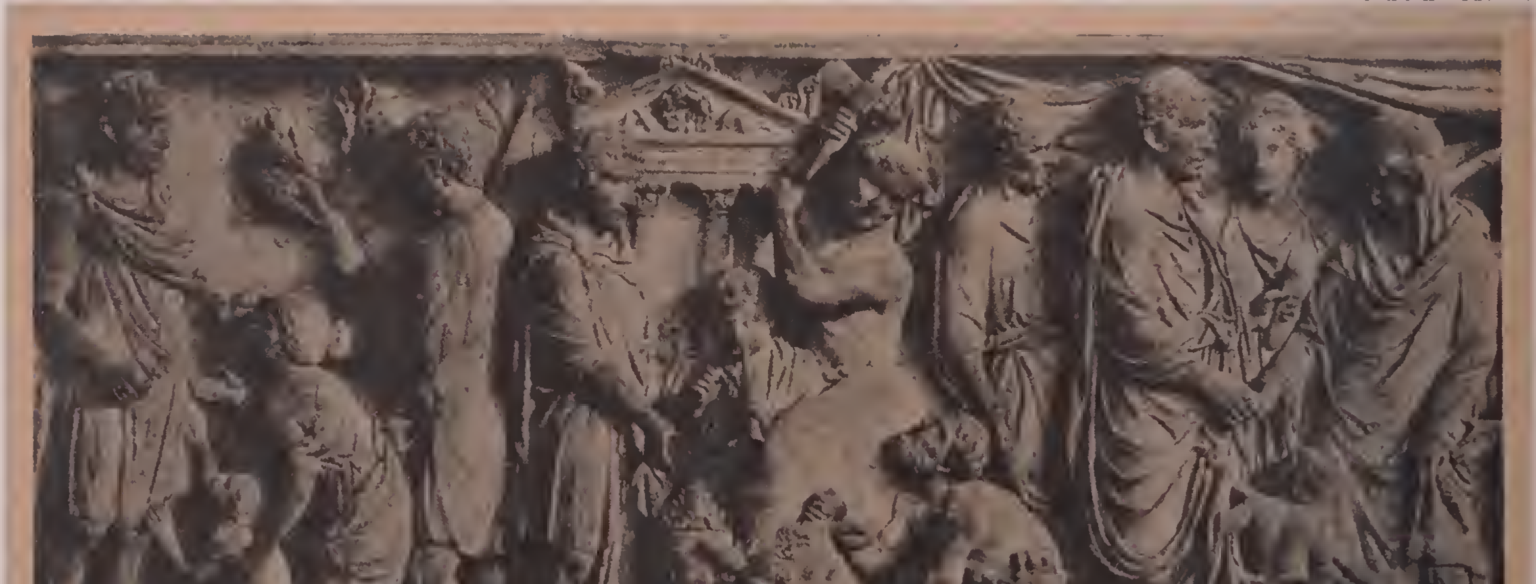
During the Middle Ages the beautiful Christian churches were made still more beautiful by a multitude of carvings and reliefs and statues. But sculpture was employed chiefly as an adjunct to architecture, and so no great individual works were produced such as the Greeks and Romans gave to the world. Sculpture as an independent art did not come into its own again until the Renaissance, the great rebirth of art and learning which took place in Italy in the 14th and 15th centuries, and thence was carried to other countries (*see* Renaissance). For inspiration the sculptors of this brilliant period turned to the models of the ancient Greeks and Romans as well as to the world of nature. Ghiberti (1378–1455), who wrought the beautiful bronze doors for the baptistry at Florence, is the first of the great sculptors of the

GREEK SCULPTURE AT ITS CLIMAX



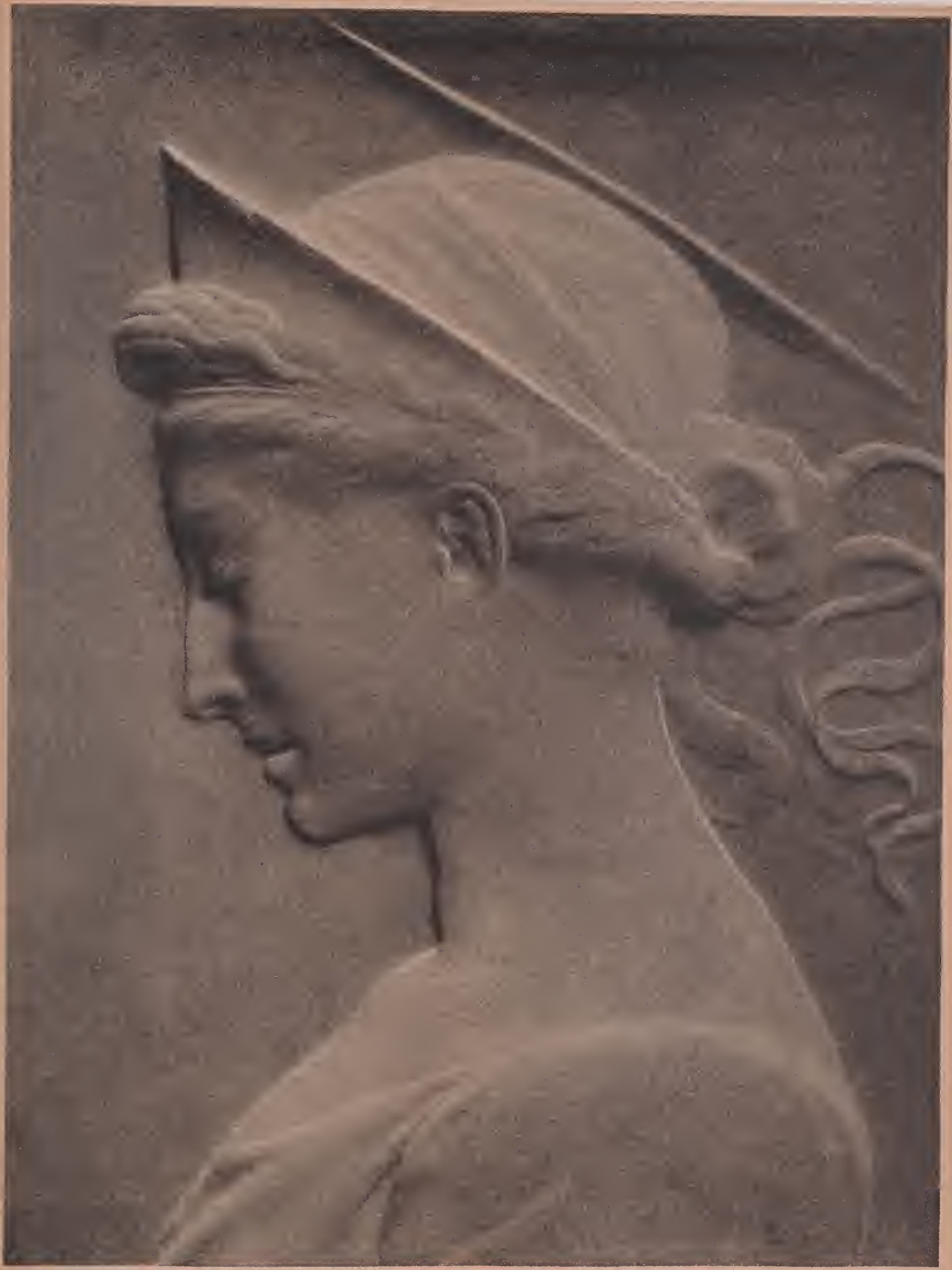
This famous statue by Praxiteles, representing Hermes carrying the young Dionysus, is the only first-rate original by a master of the first rank that has come down from Greek antiquity. It was by such masterpieces as this that the Greek genius set for the world the ideals of human beauty. This statue was discovered in the course of excavations at Olympia, Greece, in 1877, and placed in the Museum of Olympia.

SCENE FROM A ROMAN SARCOPHAGUS OF THE FIRST CENTURY A.D.



In this relief from a sarcophagus of the First Century A.D., depicting scenes from the life of an illustrious Roman, you see how much Roman sculpture owed to the Greeks. You can also see that the artists of this period were less ruled by the spirit of ideal beauty than by a striving for realistic fidelity to life. In nearly all Greek work the faces are idealized to represent the sculptor's conception of supreme beauty, but the unknown Roman artist who chiseled this sarcophagus has so faithfully worked out the rather stern and unlovely features of his principal subject that you feel you would recognize him if you met him on the street.

'ST. CECILIA'—A MASTER WORK IN BAS-RELIEF



None of the works of art inspired by St. Cecilia, the patron saint of music, is more deservedly popular than this lovely "poem in stone," which is so nearly perfect that until recently it was believed to be from the hand of Donatello, who dominated the Italian Renaissance until the days of Michelangelo. Though we do not know whose work it is, it stands as one of the most superb examples of what an artist with genius can achieve in the form of sculpture called "bas-relief." Contrast the height to which the figures stand out from the background in the Roman sarcophagus on the opposite page (*alto-rilievo*) with the shallow projection of this work.

Renaissance (*see* Ghiberti). Donatello (1386–1466) won distinction through his vigor and truth to nature, shown in such statues as his 'St. George'; and in his depiction of the charm and grace of childhood, as in his relief for the singing gallery in the cathedral at Florence. He made the first great equestrian statue of modern times, the bronze monument of Gattemalata, a noted military leader in Padua. One of his pupils, however, Verrocchio (1435–1488), made a still more beautiful equestrian statue, that of Colleoni, in Venice, which is generally considered the greatest equestrian statue in the world. In looking at it one forgets the heavy bronze of the monument, so wonderfully does the sculptor create the impression of free movement. Strong and defiant the soldier sits astride his splendid horse, which, with arched neck and left foot raised, seems just about to step forward.

Luca della Robbia (1400–1482) and his nephew Andrea della Robbia (1435–1525) produced some of the most delightful works in the whole realm of sculpture. Luca executed a relief for a second singing gallery in the Florence cathedral, which is remarkable for the grace, the naturalness, and the animated expression of its figures. It has been said that the music of its dancing and playing children has gone round the world. Besides his work in marble, Luca della Robbia applied enamel to terra cotta plaques, producing what has come to be known as della Robbia ware; he did not actually invent, but merely perfected the process, which he passed on to other members of his family. It was the nephew Andrea who modeled the charming little white babies on blue backgrounds which decorate the foundling asylum at Florence, and are known by countless copies.

The Climax of the Renaissance

With the great figure of Michelangelo, in the 16th century, Renaissance sculpture reached its culmination. As someone has put it, he "stood on the shoulders of Donatello and Verrocchio, and added to their supreme science the passion, frenzy, and explosive power of his own volcanic nature." Read the story of Michelangelo, told elsewhere in this work, and you will understand why it was that no one could follow successfully in the footsteps of this powerful genius, and why therefore it was inevitable that sculpture should suffer a decline after his death. The Florentine Benvenuto Cellini (1500–1571), whose adventurous career may be read in his autobiography, was distinguished first for his exquisite work as a goldsmith, but later for his beautiful statue of Perseus and other works in bronze; and Giovanni da Bologna (1524–1608) won fame for his graceful Flying Mercury. But more and more sculpture falls into artificial mannerism, becoming very elaborate, delicate, and fanciful, with nothing of the simplicity and calm of the Greeks or the power of Michelangelo.

From the restless striving for cheap and exaggerated effect (the *baroque* style) which characterized this period, there came a reaction in the 18th century and an attempt to return to the simplicity of classic art. This movement, like the Renaissance, began in Italy, and its leader was Canova (1757–1822). Canova's statues of Theseus, of Apollo, of Cupid and Psyche, and other Greek figures were welcomed for their perfection of form, their delicate and careful execution. He was not a genius of the highest rank; much of his work is dull and lifeless, and he is lacking in strength, in great imagination and feeling. But to him belongs the honor of having restored sculpture to the place which it had lost among the arts.

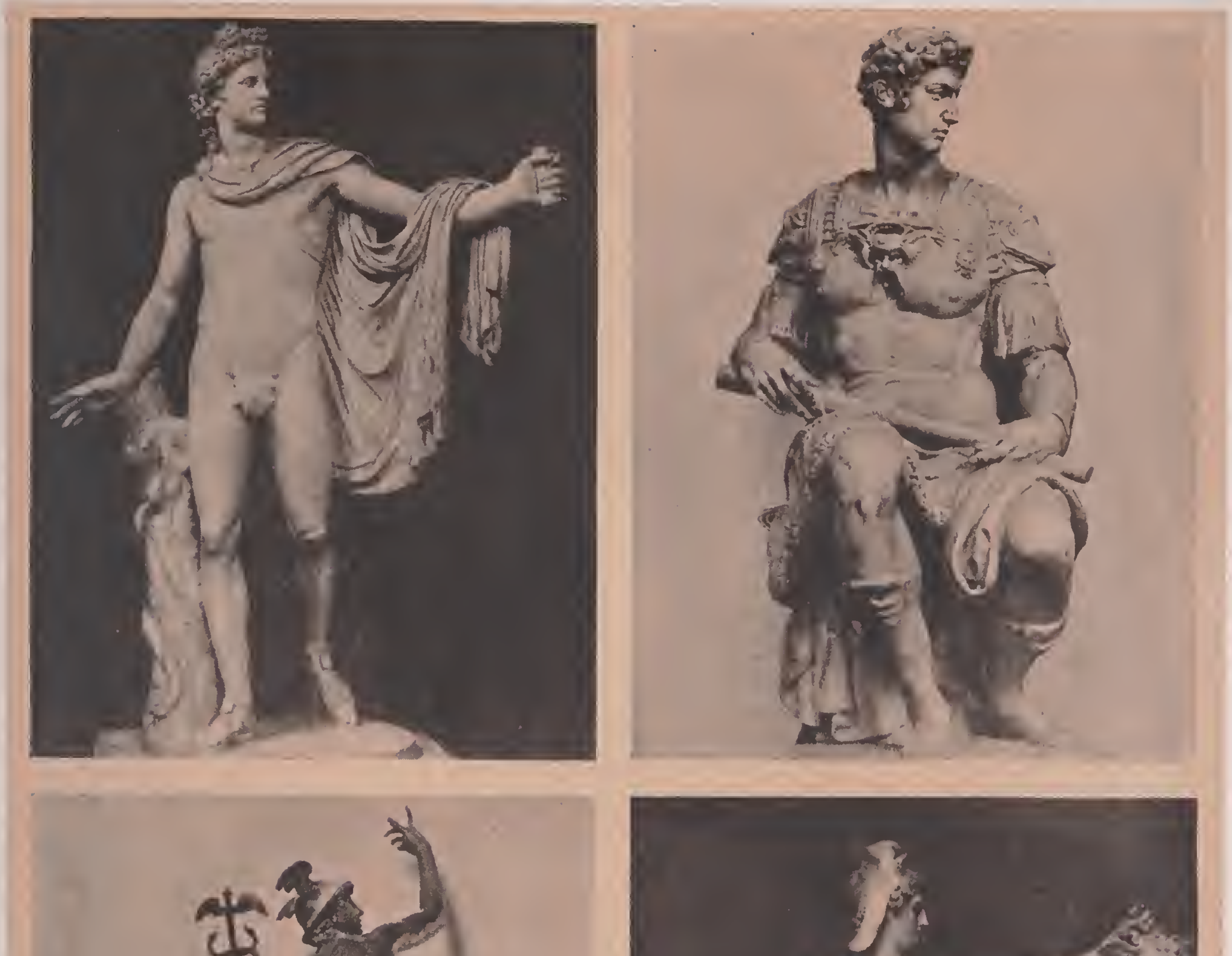
The Classic Revival in the 18th Century

Among those who helped to carry on this movement was the Danish sculptor Thorwaldsen (1770–1844), who came to Rome in 1797. Beholding for the first time the treasures of ancient art, he said that his birth should be reckoned from that date, for only then did he begin to live. Besides his subjects taken from Greek mythology, he is famous for the lifelike Lion of Lucerne carved after his model in the natural sandstone near the "Glacier Garden" of Lucerne. It commemorates the Swiss guards who fell defending the Palace of the Tuileries against a French Revolutionary mob in 1792. His group of Christ and the Twelve Apostles in the Church of Our Lady in his native city of Copenhagen is also well known. Thorwaldsen approached more nearly than any of the other classical imitators, perhaps, to the spirit of Greek art; but after a time it became apparent that his work, like that of Canova, and that of Flaxman and Gibson in England and Dannecker in Germany, lacked vitality. It was cold and lifeless, as all art must be which is mere imitation and does not show contact with real life.

Among the first to turn from the imitation of classic models and to infuse new life and feeling into his work was the French sculptor Houdon (1741–1828), whose portraits of Voltaire, Rousseau, Napoleon, Molière, and Mirabeau make these historic figures real for all time. Another Frenchman, Barye (1796–1875), called "the Michelangelo of wild beasts," represented the life and movement of animals as sculpture had never done before. Other French sculptors of the 19th century—Rude, who made the inspiring group of figures in high relief on the Parisian Arch of Triumph, called 'The Departure'; Bartholdi, to whom we owe the colossal Statue of Liberty in New York harbor; Chapu, known by his beautiful 'Joan of Arc'; Frémiet, Dubois, and Barrias—show much of the classic spirit in their work, combined, however, with a strong individuality. Constantin Meunier, of Belgium, was the first to represent the workingman in sculpture. He has been called the "Millet of sculpture," though his subjects are not peasants, like those of the great painter, but miners and artisans. Rodin of France, the greatest sculptor since Michelangelo, broke away entirely from the smooth classical school to represent the stern and rugged realities of life (*see* Rodin).

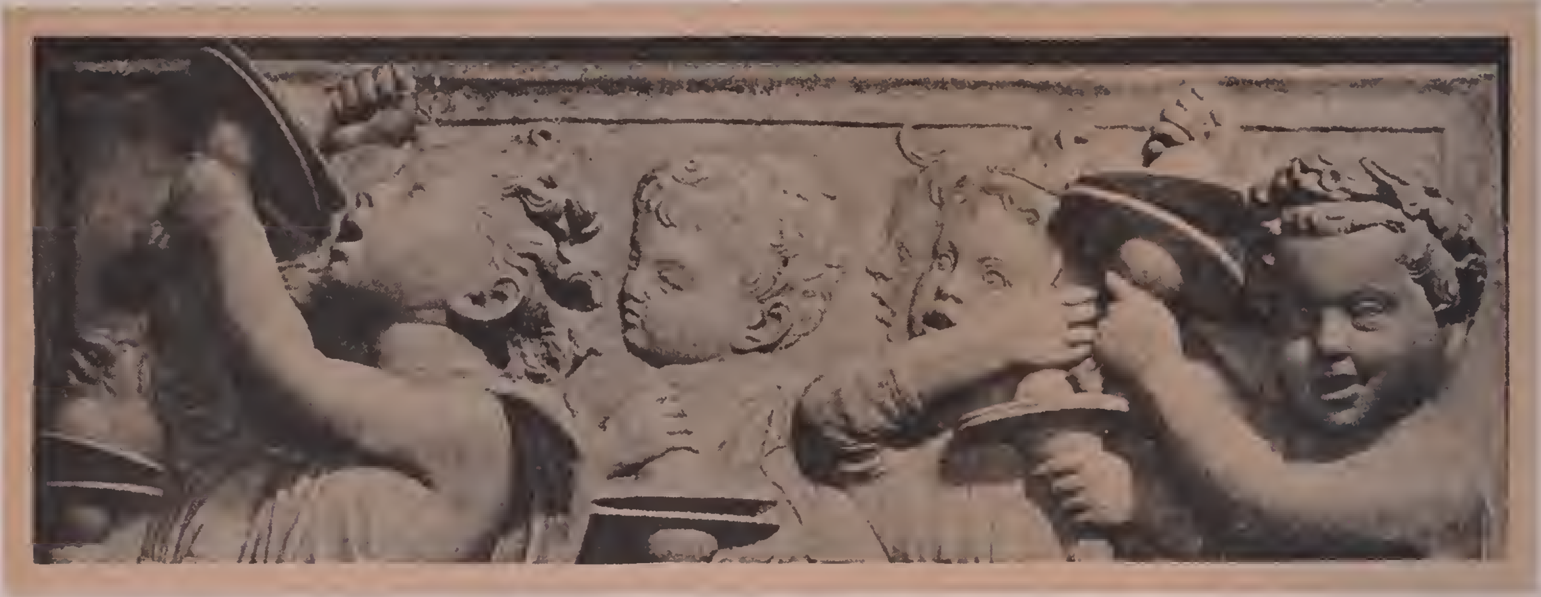
(*Continued on page 3164*)

MASTERPIECES OF THE SCULPTOR'S ART

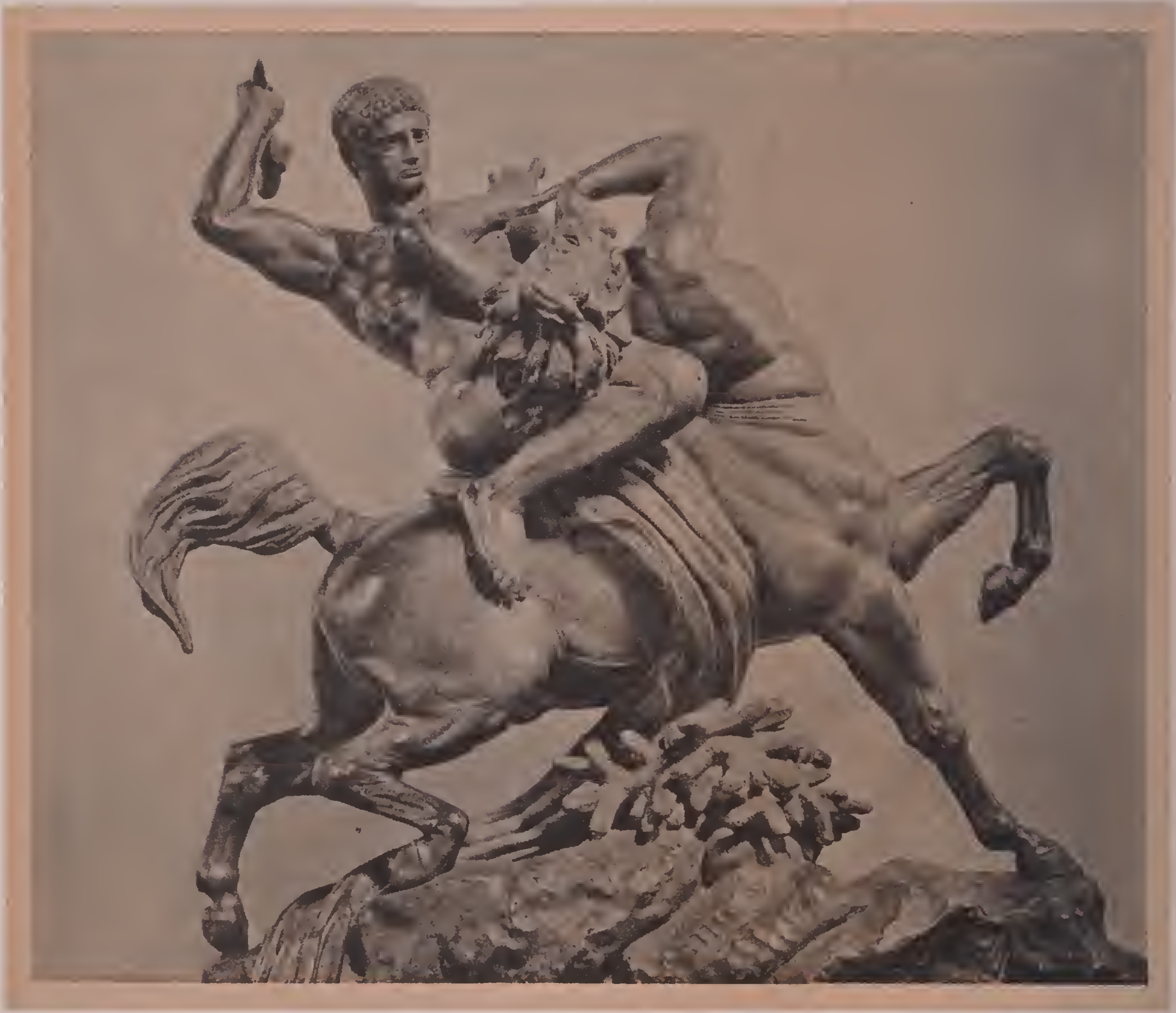


On this first page of our gallery of famous statues are four works, which, although they belong to three different periods, covering a span of 2,000 years, are properly grouped together because they show the persistence of Greek influence. The 'Apollo Belvedere' (upper left), in the Vatican Museum at Rome, is regarded as an example of the highest Greek art. It is really a careful Roman copy of a Greek statue of the 3rd or 4th century B.C. The figure of Giuliano de'Medici (upper right), which stands in the church of San Lorenzo at Florence, is by Michelangelo, the master of the Renaissance. The technical perfection of the Roman cuirass and the hands holding the general's staff have been the envy of generations of later sculptors. The 'Flying Mercury' by Giovanni da Bologna (lower left), in the National Museum at Florence, also belongs to the great Renaissance; but the figure of Perseus with the head of Medusa (Vatican Museum, Rome) is by Canova, the leader of an 18th century classic revival or "Second Renaissance."

EXAMPLES OF REALISM IN THE 16TH AND 19TH CENTURIES

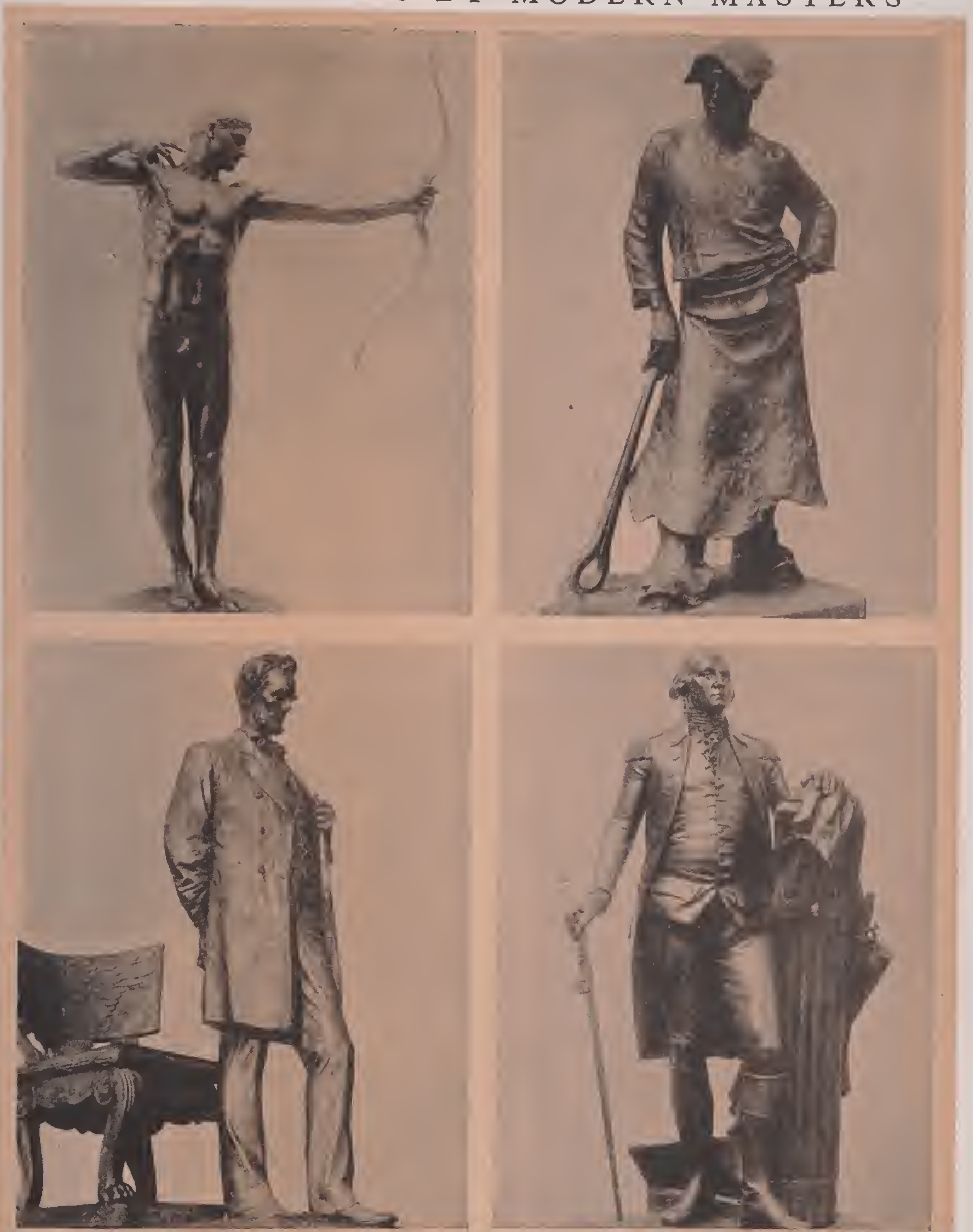


This photograph shows a part of the noted 'Singing Galleries', the earliest known work and masterpiece of Luca della Robbia, in the Museo dell' Opera, Florence. Where, in the whole realm of sculpture, will you look for a more delightful expression of the spirit of youth? No wonder "the music of its dancing and playing children has gone around the world."



In the celebrated 'Theseus Slaying the Centaur' of the French sculptor Antoine Louis Barye (1796-1875), a feeling for beauty almost classical in its perfection is combined with a distinctively modern vigor of style. Notice the contrast between the expression of inflexible will in the human figure and the wild brute passion of the animal. Barye, who is regarded as the greatest modern French sculptor of animal life, excelled in the expression of such symbolical ideas. This group is in the Corcoran Art Gallery, Washington.

FAMOUS WORKS BY MODERN MASTERS



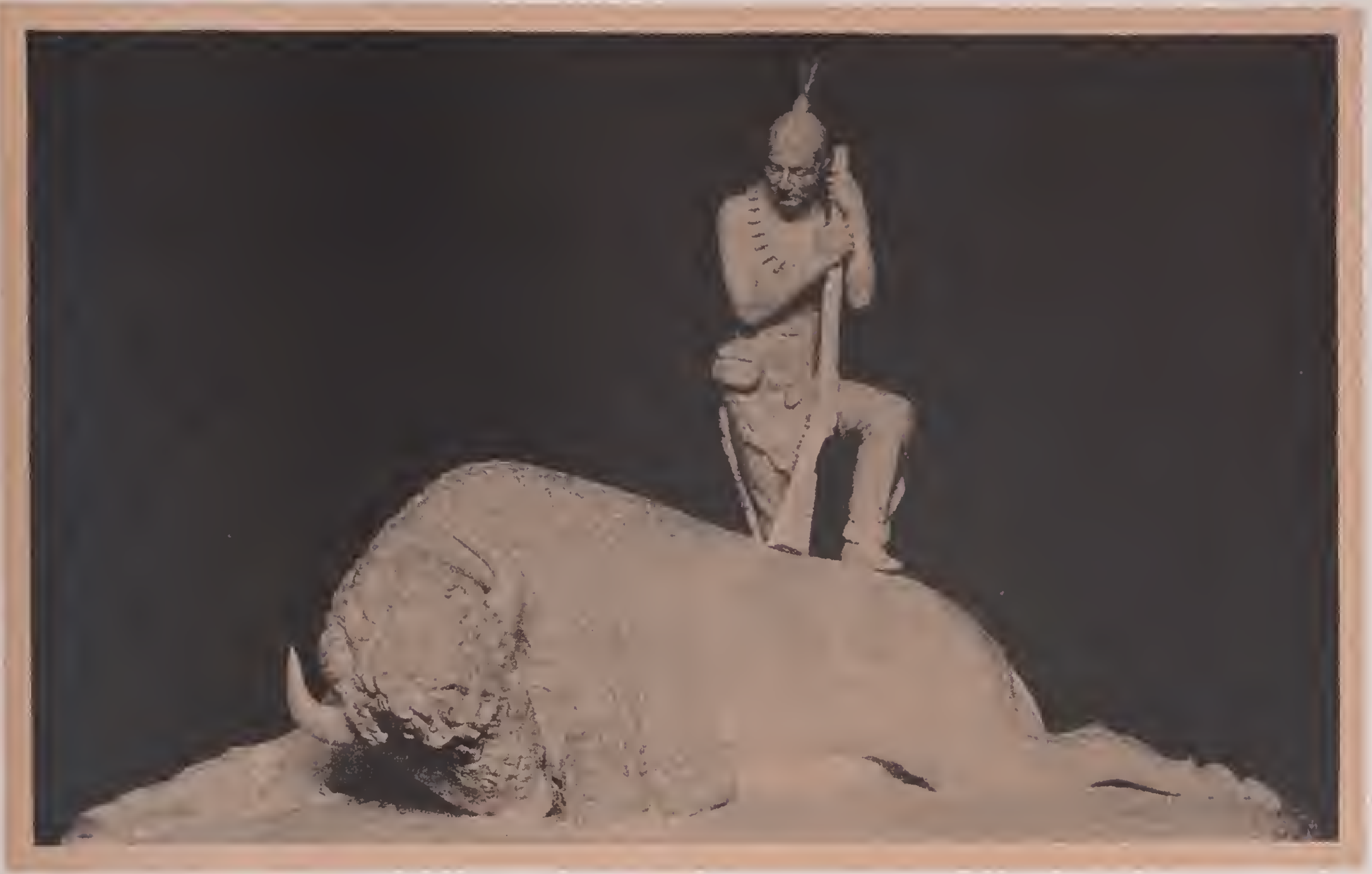
Contrast the classical beauty of the 'Teucer' (upper left) with the rugged vigor of 'The Hammerman' by its side. The former, by Sir William Hamo Thornycroft (born 1850), is in the Tate Gallery, London; the latter, by Constantin Meunier (1831–1905), is in the Chicago Art Institute. The celebrated statue of George Washington, by Antoine Houdon (1741–1828), is in the Virginia Capitol at Richmond. Saint Gaudens' colossal 'Lincoln' is in Lincoln Park, Chicago.

SOME ACHIEVEMENTS OF MODERN FRENCH ART

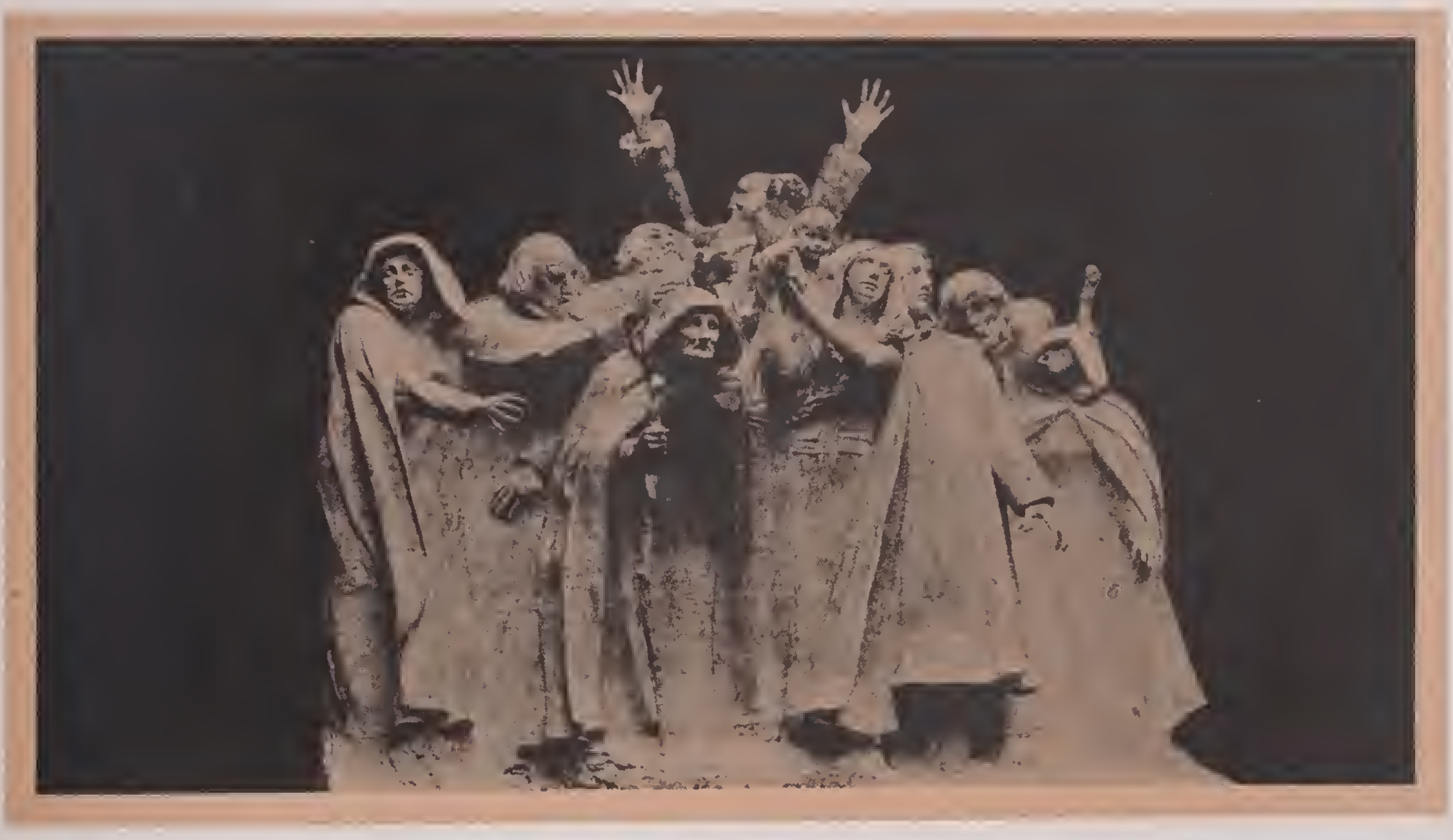
One critic has said that François Rude (1784-1855), "by the mere force of a strong plebeian temperament, quite naturally happened on a style of art—high art—at once expressive and popular." This figure, called 'The Neapolitan Fisherboy', is in the Louvre, Paris.

Henri Chapu (1833-1891) was a deep student of Greek sculpture, and this figure of Joan of Arc (Luxembourg Museum, Paris) is conceived in the simple and lofty Greek spirit which distinguished his work. The bust of J. P. Laurens (also in the Luxembourg) is by Rodin, considered the greatest sculptor of the 19th century, who scorned the classical tradition and sought only to depict human character and emotion in their physical expression.

CLASSICISM AND REALISM IN AMERICAN ART



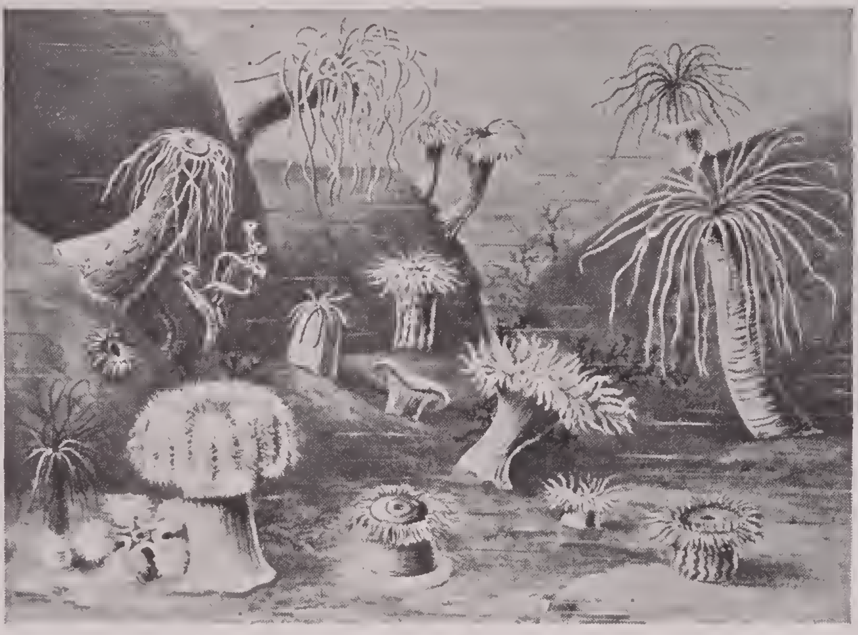
In this group, called 'The Buffalo Group', by Preston Powers, an American sculptor, there is a fineness of finish which could only be acquired by one trained in the classic mode. But the dead buffalo, is after all, a very handsome buffalo, and the Indian is almost too idealized and too cleanly modeled. If there were the least bit of irregularity about the group we should be inclined to give it credit for greater strength.



The group of 'The Blind', by Lorado Taft (born 1860), is one of the most notable pieces of work by that sculptor. It was directly inspired by Maeterlinck's play 'The Blind', and it reveals clearly the influence of the modern French spirit and technique in sculpture. It has that vividness of feeling, with freedom and naturalness of expression, which is typical of Taft's work. These characteristics, in fact, are typical of all first-rate American sculpture since about 1880.

The 'Greek Slave' of Hiram Powers (1805–1873) was the first work of sculpture in the United States to attract the attention of the world. Powers followed Canova in his imitation of classic art. His work is no longer considered of high merit, but it did much to arouse a taste for sculpture in the New World. It was not long before American sculptors began to develop a vigorous originality. The true American spirit was expressed by Henry Kirke Brown (1814–86) in his fine equestrian statue of Washington, and by his pupil John Quincy Adams Ward (1830–1910) in his statues of Indians and negroes, as well as in his portraits of Horace Greeley and Henry Ward Beecher. Augustus Saint-Gaudens, whose story is told elsewhere, rose to still greater heights in commemorating and interpreting great characters in American history. Frederick MacMonnies, his pupil, has produced work of a very different order, full of lightness and grace and buoyancy. Daniel Chester French is distinguished by the purity and ideal beauty of his work, shown in his well-known 'Death and the Sculptor', and in many fine portrait statues. Paul W. Bartlett is known by his impressive statues of Michelangelo and Columbus in the Congressional Library. George Grey Barnard has sought to express, as in his 'Two Natures', the great underlying forces of human life. His realistically modern 'Lincoln' has aroused much comment, favorable and unfavorable. Solon Borglum, one of the most original of American sculptors, has depicted with great truth and sympathy the vanishing life of the western frontier; while his brother, Gutzon Borglum, has also shown great vigor in his many ambitious works, which include two well-known portraits of Lincoln, a seated figure at Newark, N. J., and a colossal head in the rotunda of the Capitol at Washington. John J. Boyle (1851–1917) expressed a strong native spirit especially in the Indian group entitled 'The Stone Age'. Karl Bitter (1867–1915), who planned the decorative sculpture for the great expositions at Buffalo, St. Louis, and San Francisco, produced a number of fine portrait statues. Charles Niehaus and Andrew O'Connor are among his most prominent successors. Lorado Taft has done much to beautify Chicago by his graceful ideal groups, and his influence as a writer and lecturer on sculpture has been very wide. Other sculptors of note are Bela L. Pratt, Hermon MacNeill, and Paul Manship.

THESE ARE NOT FLOWERS, BUT ANIMALS



This group of Sea-Anemones might be taken for a view in some mysterious garden visited by Alice in Wonderland. But the Sea-Anemone is not a plant but an animal, and it can move very slowly over the rocks to which it attaches itself.

Sculpture by its very nature admits of less freedom and unconventionality than painting, though there have been some rebellious spirits who have sought to break through its limitations. The extreme modern movement may be traced back to Rodin, though its followers have gone to far greater extremes than the great French sculptor. In the United States such works as Barnard's 'Lincoln' exemplify this tendency. A leading figure in the new movement in England is Jacob Epstein, who aroused much comment, mostly unfavorable, by his ultra-realistic statue of 'The Risen Christ'. Even more revolutionary have been the attempts of small groups in various countries, the so-called "futurists," "cubists," and other "post impressionists" to make sculpture, like painting, serve to present ideas, divorced entirely from the imitation of objects in nature (*see* Painting).

SEA-ANEMONE. Often at the seashore you will see, attached to the pilings or to rocks, groups of queer little creatures with petal-like tentacles waving languidly in the current, which could almost be taken for copies of brilliantly colored garden asters. These are sea-anemones, a kind of polyp which usually does not secrete a coral stock. They are found in all seas, but are especially plentiful in temperate zones.

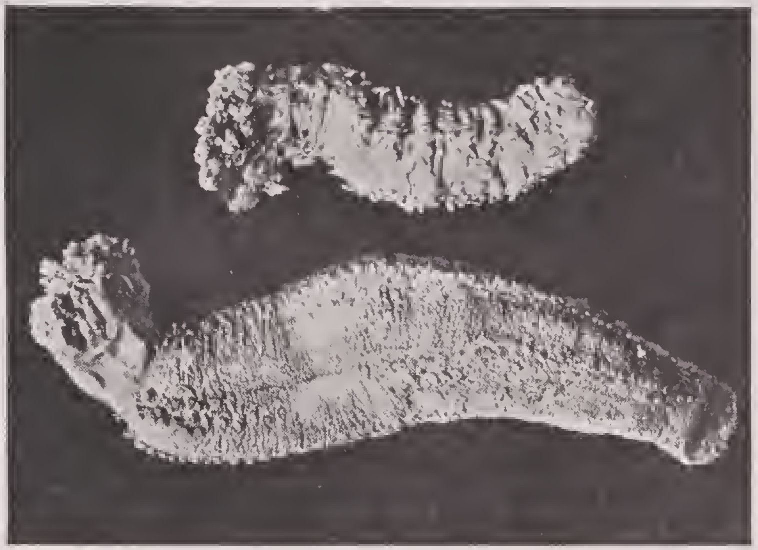
Sea-anemones vary in size from a quarter of an inch across the extended flower face to more than a foot in diameter; only a few, however, are more than three inches across. Their bodies are short hollow cylinders of soft flesh with a spreading base. At the free end is the mouth, about which are one or more circles of tentacles. In the outer skin of the tentacles are thousands of minute stinging threads, all curled up into tiny balls, ready for use. When a small fish or other animal comes swimming along, the sea-anemone shoots out from these "lasso cells" its barbed threads, which contain a poison that paralyzes or kills its prey. Both the mouth and the body cavity can be extended and the sea-anemone often devours an animal nearly as large as itself. Indigestible waste is ejected through the mouth.

Anemones multiply sometimes by budding or by division, but usually by eggs. The young swim in the water for awhile until they find a spot on which to settle and grow. Along with most corals, sea-fans, and sea-feathers, the sea-anemone belongs to the class of *Anthozoa* or "flower-animals."

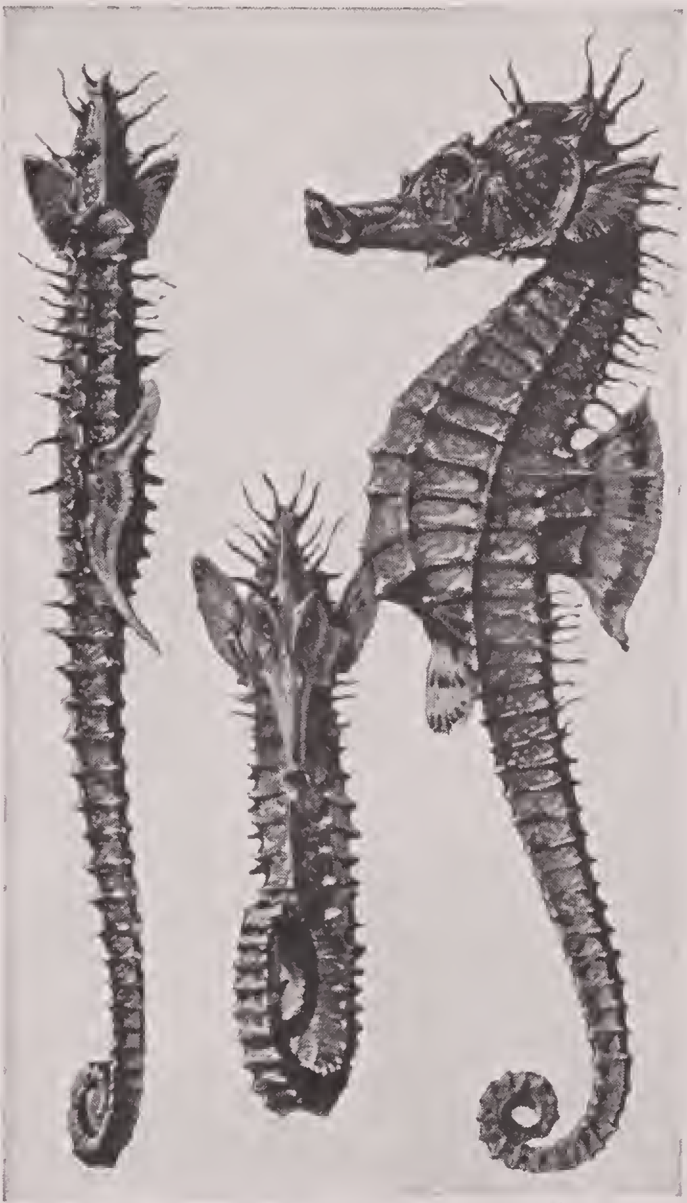
SEA-CUCUMBER. If a Chinese cook says he will have "cucumbers" for dinner, don't be too sure that you know what he means. He may be planning one of his favorite native dishes made of "sea-cucumbers," sometimes called *trepang* or *bêche-de-mer*. "Sea-cucumber" or "holothurian" is a term applied to a low class of marine animals, whose bodies are composed of elastic muscular tissue, covered with warts or spines, and which generally resemble in shape their vegetable namesake. At one end of their body is the mouth surrounded by small sensitive tentacles with which their food is gathered. The common sea-urchin and starfish, found on almost all sea-coasts, belong to the same group (called Echinoderms) as the sea-cucumber, but the latter lacks the characteristic covering of living plates. (*See* Starfish and Sea-Urchins.)

Trepang is considered a great luxury among the Chinese, Malays, and other Eastern peoples, and its gathering and preparation for the market is a flourishing industry among the islands of the Pacific, even to the California coast. White men who have eaten sea-cucumber soup declare it to be delicious. The trepangs, which grow from 10 to 15 inches long, are gathered from coral reefs, and are boiled, dried in the sun, then over a fire, which gives them a smoky taste. The highest grade has been sold for $1,000 a ton.

STRANGE CREATURES FROM THE SEA



The Sea-Cucumber got his name because he sometimes is large and fat enough to look like his vegetable namesake, but more often he looks like a giant caterpillar or worm. When he moves, his body contracts and expands just like a worm's. Over 600 species of sea-cucumbers are known.



If the Sea-Horse were larger, he would certainly cause alarm wherever he appeared, but fortunately the common sea-horse of the North American coast is only from three to six inches long, and the largest species known is only two feet long.

SEA-HORSE. With a head shaped like that of a tiny prancing charger and a tail like a snake's, there is little about the "sea-horse" to suggest that it is really a fish. Nor do its habits follow those of the finny tribe. At times it swims upright through the water with the aid of its single back fin, but usually it remains at rest with its tail curled around a bit of seaweed to keep from being swept away. Thus anchored, it looks like some strange pigmy dragon out of a fairy tale.

But perhaps the most peculiar thing about these creatures is the method of caring for their eggs. The male carries them around in his "vest pocket," a sort of pouch like a kangaroo's, until they are hatched. And even after they are hatched out, the young take refuge in the paternal pouch when alarmed, continuing this practice until they are old enough to forage about for themselves.

Sea-horses are found in small numbers in nearly all of the warm and temperate seas. They belong to the pipefish family, but their swimming powers are feeble. Clothed in bony plates and spines, and closely resembling in color the weeds among which they dwell, they are able despite their helplessness to escape their many enemies.

A near relative of the sea-horse, called the "sea-dragon," is a native of Australian waters. It is covered with countless flaps and appendages which give it the exact appearance of seaweeds. This curious fish, like the sea-horse, and all the other members of the pipefish group, has a slender snout through which it sucks up its food, consisting of small sea creatures and the eggs of other fishes.

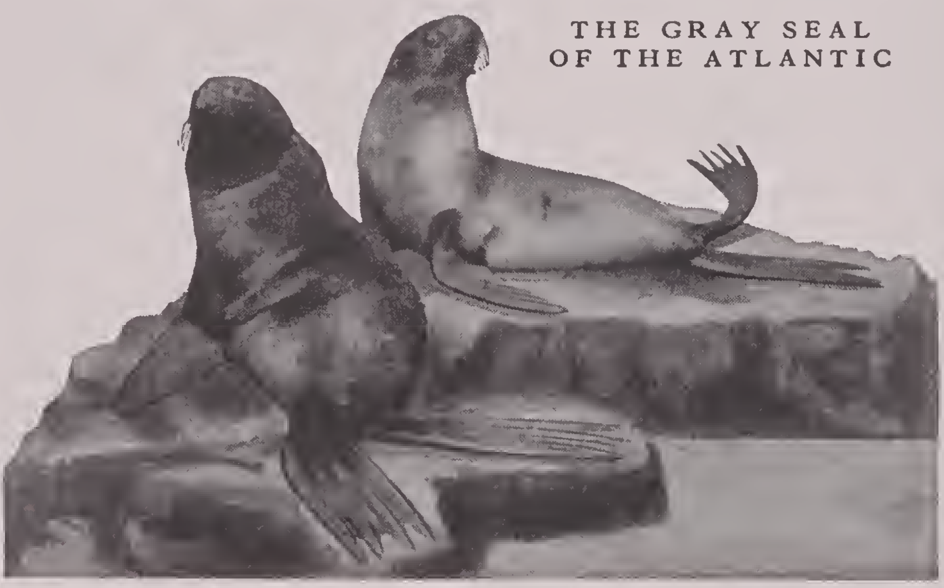
There are some 40 species of sea-horses, ranging in size from 2 to 12 inches. The common sea-horse of the Atlantic coast of North America reaches a length of about six inches. Scientific name of this species, *Hippocampus hudsonius*.

The ORIGINAL OWNERS *of* SEALSKIN COATS

But the Fur Seal is not a true Seal, and the true Seal has no fur coat. This article tells you how to distinguish the various kinds of Seals, and their cousins the Sea-Lions and the curious Sea-Elephants.

SEAL. The animal from which is obtained the valuable fur called "sealskin" is not a "true" seal, but a sea-bear! True seals (which belong to the family *Phocidae*) do not possess external ears, and their limbs are more highly modified than in the fur seal. Their hind limbs, or flippers, are stretched backward and closely united together, and are of no use in walking on land, which is accomplished by a wriggling or shuffling action of the body, at times assisted by the fore limbs. The fur seals and their relatives (family *Otariidae*), on the other hand, both have external ears and can walk and run on all four feet, and thus are nearer to the land-animal type from which they developed. All seals are mammals. One or occasionally two young are produced annually, and these are at first covered with a coat of thick soft nearly white fur, which in some species is retained for two weeks or more. The young do not take to the water until this fur is shed, when they are taught by the mother to swim—often quite reluctantly!

THE GRAY SEAL OF THE ATLANTIC



This variety of Seal is known only in the North Atlantic Ocean. It is one of the largest species, often reaching a length of eight feet. In color it is a yellowish gray, the back being somewhat darker than the belly, and is often spotted with darker gray or brownish-black splotches.

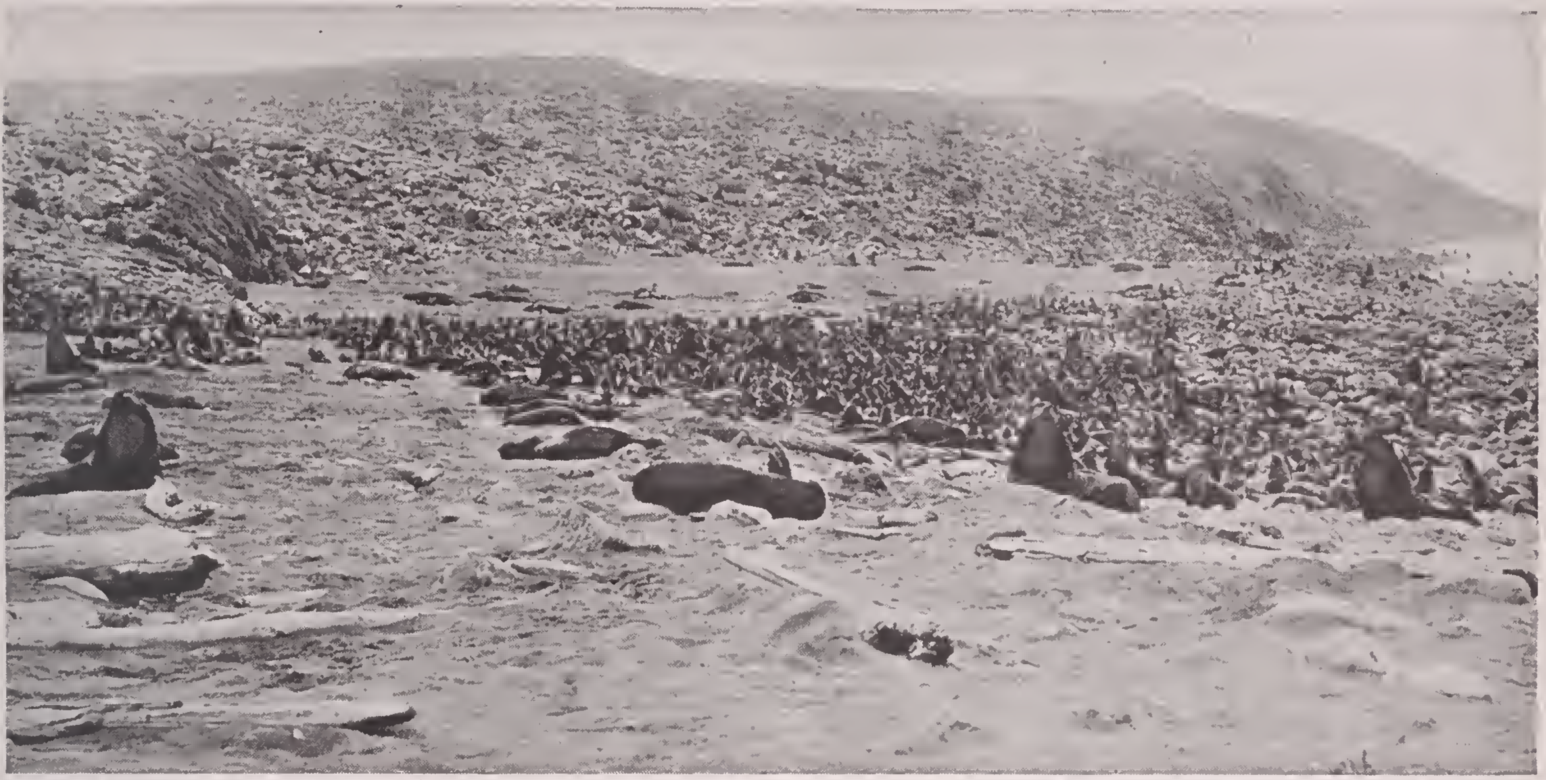
The common harbor or "leopard seal" (so called on account of its spots) is the most widely distributed and best known of the true or hair seals. It is found along the European shores of the Atlantic and Arctic oceans, as well as along the shores of North America, and it ranges south in the North Pacific to the coast of Japan. Its usual haunts are the rocky points of the mainland coast and islands, but it has been known to ascend the St. Lawrence to Lake Champlain and Lake Huron, and the Yukon several hundred miles from its mouth. It does not migrate, but frequents the pack-ice along shore in winter. It is not as social in its habits as the fur seal, but small herds collect on islets during the breeding season. The young are born in early spring, and the mother is devoted to them, showing deep anxiety if danger threatens.

A HOODED SEAL

The flesh and blubber of this seal are valued by the Eskimos. The skins are used for clothing and in making rawhide nets. The harbor seal is said to be intelligent, docile, and affectionate when tamed. It shows little fear of human beings unless hunted, when it becomes shy and wary. This seal is small, attaining a length of only five or six feet, and therefore is not hunted extensively for commercial purposes.

The Greenland seal, also called the "harp seal" or "saddle-back," because of the striking color pattern of its back, is also a true seal. This is a larger species, old males weighing as much as 800 pounds. It occurs in the northern waters of both hemispheres. In North Atlantic waters it migrates southward with the ice-pack in autumn to the coast of Newfoundland and returns northward with the pack after the breeding season in spring. It also is extremely social and gathers in large numbers on the pack ice off Newfoundland, during March and April, to breed. Originally there were enormous numbers of these animals, and the value of their skins and blubber made them the basis of a great industry. Hundreds of vessels were sent out from American and European ports, and nearly a million seals were killed during each breeding season. This terrible slaughter has so reduced their numbers that now little sealing is done. This is well, because many human lives were lost in sealing, hundreds of men being miserably frozen on the drifting ice or drowned with their sinking ships.

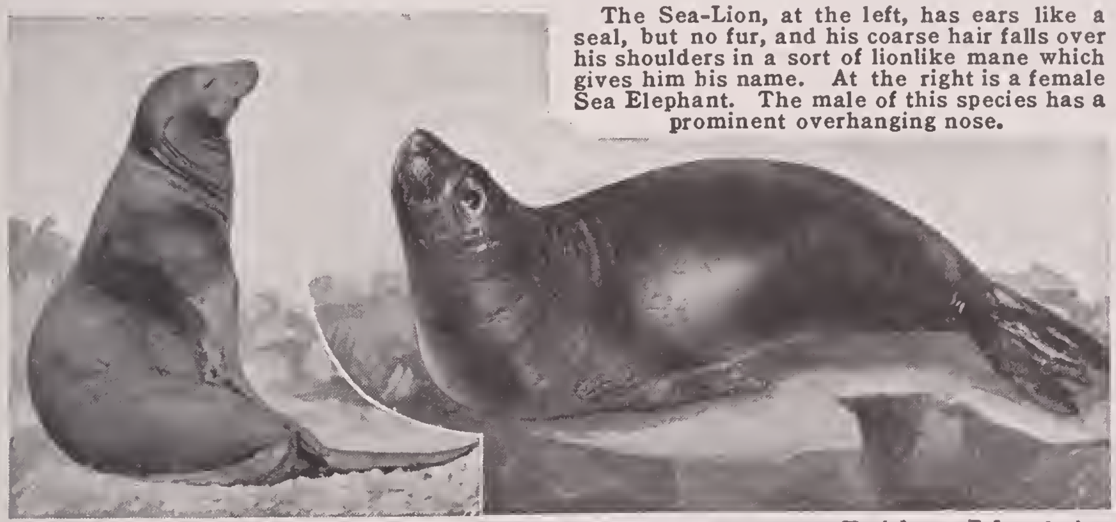
A SEAL ROOKERY ON THE PRIBILOF ISLANDS



This is a part of the largest remaining herd of Fur Seals, including about 600,000 individuals, which make the Pribilof Islands their summer home. Ages ago probably all seals were land animals, but now they come to land only to breed and rear their young. Each year, about the first of May, the adult males land, and pick out their places on the shore. Late comers are driven away and forced to seek less desirable locations. A month later the "cows" begin to arrive.

The broad-banded markings of the male "ribbon seal" make it the most strongly characterized of the true seals. Its home is in the North Pacific. It has been captured about the shores of Kamchatka, and on the coast of North America south of the Yukon delta and from Cape Nome to Bering Strait. Because of its attractive markings, the skin of the male is greatly prized by the Eskimos, who hunt it in their *kyaks* in spring and fall. But the scarcity of the ribbon seal, and its solitary habits, serve to safeguard it from the dangers to which its more social relatives are exposed.

COUSINS OF THE FUR SEAL



The Sea-Lion, at the left, has ears like a seal, but no fur, and his coarse hair falls over his shoulders in a sort of lionlike mane which gives him his name. At the right is a female Sea Elephant. The male of this species has a prominent overhanging nose.

This is about the Fur Seal

The "fur seals" that yield the beautiful sealskin have external ears and are so closely related in structure to the bears that they are often called "sea-bears." In habits and general appearance, however, they resemble the true seals. Their limbs are longer and of more practical use on land, and for a distance of 100 feet they can run faster than a man can walk.

The young fur seals at first possess a woolly black coat, later changing into the soft brownish fur which makes their skins so much prized for women's wraps and coats.

There are two groups or genera of fur seals—the one (called *Arctocephalus*) whose species formerly inhabited the Southern Hemisphere, off the Pacific coast and islands of South America, and the waters of Australia, New Zealand, and South Africa, but which have now practically all been killed off; and the other (called *Otoës*) which is confined to the waters of the North Pacific. There are now three different herds of these fur seals of the North Pacific. The smallest, which numbers perhaps 10,000 individuals, breeds on Robben Island in the Sea of Okhotsk and the nearby Kuril Islands, and migrates into the Sea of Japan; this herd is controlled by the Japanese government. The second herd breeds on the Commander Islands in Bering Sea, and is under the control of Russia. The third and largest herd breeds on the Pribilof Islands, off the Alaskan coast, and is under the control of the United States. It migrates southward through the passes of the Aleutian Islands, and returns along the western coast of North America, traveling from southern California to the Bering Sea. When the United States purchased Alaska this herd probably numbered 2,500,000 seals, but it has now been reduced to about 600,000.

A MOTHER SEAL AND HER YOUNG

In this group of Fur Seals, you can see clearly the powerful flippers which enable them to walk on all fours, unlike the true seals.

In the breeding season, a visit to the fog-shrouded Pribilof Islands, in the isolation of Bering Sea, over 200 miles from the Alaskan coast, is an interesting experience. The full-grown "bulls," seven years or more old and weighing 400 to 500 pounds, arrive first, early in May, and select the places for the "rookeries" on the bowlder-strewn beaches. Later the "cows" arrive, and take their places in close packed herds or "harems" of varying sizes (up to 100), each herd about a bull. There is much fighting among the bulls, and the young "bachelor" males are forced to herd by themselves on nearby but separate beaches. It is these "bachelor" males alone that are permitted to be killed under regulations of the United States government. The young are born soon after the "cows" arrive, and within a week or so the mother goes off to sea to feed, returning at gradually lengthening intervals to nurse her young (called a "pup"). The bulls keep jealous watch over their herds and young without once leaving the beach or taking food, from May until August. Then they too put out to sea in search of food, chiefly of squid and fish, of which seals consume enormous quantities.

During the first season the young subsist entirely on their mother's milk; before the fall migration begins the young are taught to swim. All seals are extremely social, and from the ages of one to four years are very playful. They follow one another about on the beaches in evident enjoyment, pulling and tugging, or diving and then leaping high into the air. Their chief enemy, aside from man, is the killer whale. During the early years of the fur-sealing industry, seals were killed in a most indiscriminate manner, both on the "rookeries" or breeding places, and in the open sea, females as well as males being taken regardless of age or condition. Japanese, Russians, Britishers, and Americans joined in the slaughter at sea, although the killing on the Pribilof "rookeries" was carefully limited by government regulations. The number of seals became so greatly reduced that the United States took measures to stop "pelagic" or open-sea sealing, and thereby became involved in a controversy with Great Britain. The dispute was finally submitted to arbitration at Paris in 1893, with the result that pelagic sealing was prohibited in a zone of 60 miles' radius around the Pribilof Islands, and it was agreed that no seals might be killed anywhere between May 1 and July 1. By treaties of the United States with Great Britain, Russia, and Japan, in 1911, *all* sealing on the high seas was prohibited for 15 years. In 1912 Congress passed a law that no fur seals should be killed on the Pribilof Islands for five years except as food for the natives. As a result of the foregoing measures the herd, which before was threatened with extinction, is now increasing in numbers.

Since 1909 the United States has directly controlled and managed its fur seal herd, taking over the rights of killing and marketing which before had been leased to a private company. The skins after dressing, dyeing, and machining are disposed of at the St. Louis fur auctions, where the better class of skins sell for from $50 to $100 each. The revenue obtained by the government since 1867 from the fur seal herd alone is already several times the $7,000,000 that it paid for the whole of Alaska, and in time it bids fair to equal if not to exceed that amount every year.

Sea-Lions and Sea-Elephants

The sea-lions are eared seals, like the fur seals, and are the largest of the group; but their hairy coats have no value as fur. The northern or Steller's sea-lion (*Eumetopias stelleri*), which frequents the shores of the North Pacific, is the best known. It is an enormous creature, sometimes attaining a length of 12 feet and weighing over 1,800 pounds. In former days the natives of the Pribilof Islands made raincoats out of the lining of its intestines, and constructed boats by stretching sea-lion skins over wooden frames.

The California sea-lion (*Zalophus californianus*) is a much smaller animal, only 7 or 8 feet long. It is often seen on the rocks of San Francisco Bay, along with Steller's sea-lion; but it is more numerous on the southern Californian and Mexican coasts, and a related form is found in Australian waters. Because of its intelligence this sea-lion is captured and trained for menagerie purposes. Among the Galapagos Islands and on both the Atlantic and Pacific coasts of South America a third sort of sea-lion is met with, *Otaria jubata.*

But the monster of the seal family is the "sea-elephant" or elephant seal, which unlike the sea-lions is classed with the true seals because of its lack of external ears. Two species are known, one on islands on the borders of the Antarctic Ocean, the other on the Pacific coast of Upper and Lower California. Their name is derived from the possession in the male of a long flexible snout or trunk which when relaxed hangs 9 or 10 inches below the muzzle.

The southern sea-elephant (*Macrorhinus leoninus*) is considerably larger than an elephant, old males measuring over 20 feet in length, with a circumference of 12 feet about the chest. At the beginning of the 19th century they were found in great herds in Juan Fernandez, the South Shetland, Falkland, and other islands about Cape Horn; but since a single individual would yield 20 gallons of excellent oil, hunters have greatly reduced their numbers. They move with ease and grace in the water, and emit a roar something like the bellowing of an ox. On shore they are sluggish and it is said they will permit a man to walk up and touch them without showing signs of fear. When attacked they become panic-stricken and escape is difficult because of their clumsy bodies and lack of other limbs than the flippers. During the breeding season the males have furious combats among themselves, a whole harem of females being the prize that goes to the victor. The proboscis or trunk serves no useful purpose, as does the trunk of the elephant. The northern sea-elephant (*Macrorhinus angustirostris*) was formerly common on the Pacific coast, but is now extinct there except for a herd of about 150 on the small island of Guadaloupe, off Lower California.

SEA-SERPENT. The early literature of many nations abounds in stories of sea-serpents, many of which are traceable to the giant squid. For these are the only known animals whose arms can be made to assume the form of a serpent. The expanded end of one of its two longest tentacles, when held just above the surface of the water, may easily be mistaken for the head, and the wavy tentacle itself, for the body of the serpent.

The supposition that giant squids are the sea-serpents of myth and fable is supported by the fact that these squids are found in the regions in which sea-serpents are said to have been seen. Sailors and fishermen have given vivid descriptions of these creatures agitating the ocean so that "the waters run like a mill"; or of their spouting water like a whale; or raising a frightful head to snap one man out of a boat without hurting the others. Some descriptions credit these creatures with the possession of staring blue eyes, bright and big as pewter plates. Norwegian sailors have affirmed that this serpent, or *kraken*, was able to lay hold of the strongest man-of-war and pull it down to the bottom of the sea. In the year 1680, it is said, a *kraken* came into the waters that run between the rocks and cliffs of the shore near a certain parish in Norway. Extending its long arms it caught hold of some trees standing near the water and entangled itself in some openings or clefts in the rock, and stuck so fast therein that it could not work itself out, and, after a terrific struggle, perished on the spot.

Stories of sea-serpents are current among fishermen on the Grand Banks of Newfoundland to this day, some of which seem quite reliable and indicate that the giant squid may at times be a source of danger to man. According to one of these stories, two fishermen were out in a small boat about nine miles from St. Johns when they saw an object in the water which they thought was the débris of a wreck. One of the men struck at it with his oar, whereupon the object immediately reared a parrot-like beak with which it struck the boat. It then entwined the boat with two huge, gray arms. The men cut these arms with an ax, and the creature ejected an immense quantity of inky fluid which darkened the water for 200 yards. It was observed that the creature was the same shape and color as the common squid, but about 50 feet long and five feet in diameter. (*See* Cuttlefish, Squid, and Octopus.)

SEAT'TLE, WASH. Coming into Seattle's harbor at dusk, you enter an enchanted land. Before you stretch ten miles of shadowy water front, with countless wharves and warehouses poking giant fingers out into the briny waters of Puget Sound. All about you dim ghostlike ships from all parts of the world grope noiselessly to their port, where they load or unload their countless wares. Here a great Alaska liner is preparing for a voyage to the northern glacier land; next it lies a majestic vessel just arrived from Liverpool by way of the Panama Canal; farther on you see ships from China and Japan with cargoes of tea and shining silk. And in the distance, to the west and east, tower mountains—vague, jagged, snow-tipped mountains, these Olympics and Cascades—endlessly sentineling this twilight wonderland.

Situated on one of the best natural land-locked harbors in the world and the gateway of the shortest route to the Orient and to Alaska, it is no wonder that Seattle, already one of the chief seaports on the Pacific coast, is fast becoming one of world importance. Eager to rival New York in its docks and shipping, the city has spent millions of dollars on harbor improvements. The most notable of these is the 8½-mile canal which connects the salt water harbor with the fresh waters of lakes Union and Washington, thus giving Seattle an unrivaled fresh water harbor, and increasing her water-front from 40 to 140 miles. This harbor also has the advantage of giving ocean vessels a fresh water bath that rids them of barnacles.

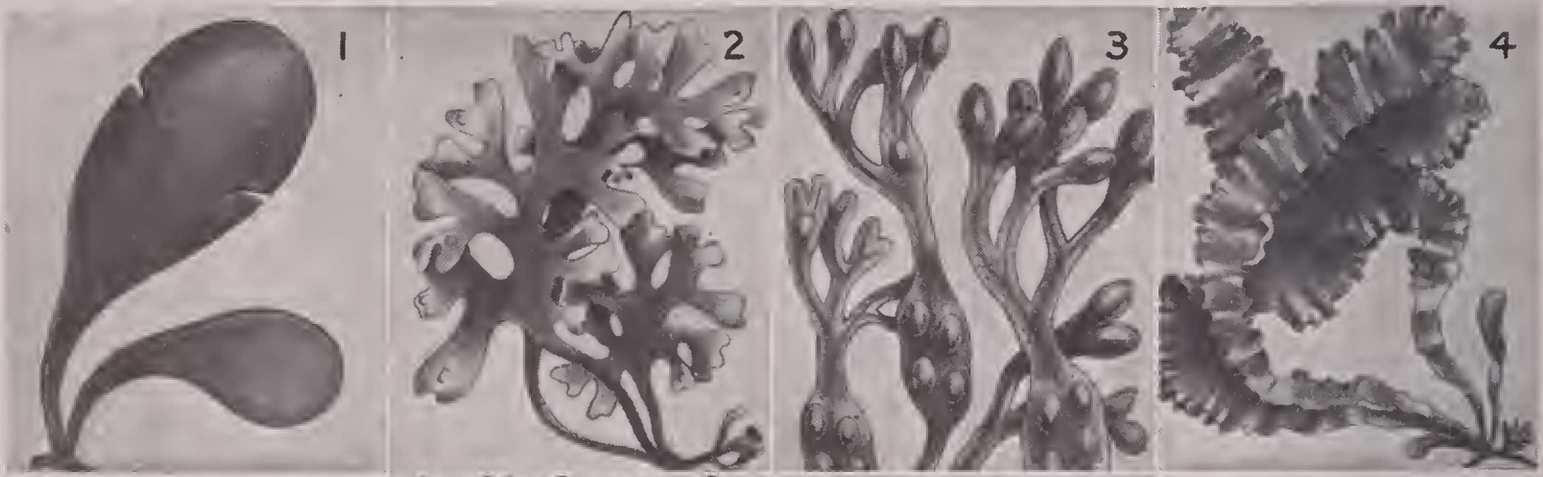
Seattle is an important gateway by land, as well as by sea, for it is the terminus of six transcontinental railroad lines. Because of this excellent transportation and because of the inexhaustible water and electric power furnished by many small nearby streams, Seattle is the most important manufacturing city in the Pacific Northwest. Shipbuilding is one of the leading industries; others are flour and rolling mills, foundries, iron works, woodworking, shingle and lumber mills, meat packing, and fish canning. Seattle is also the greatest marketing center on the Pacific coast for fruit, vegetables, and dairy products, as it is the base of supplies for the logging camps, lumber mills, and mines of Washington, Alaska, and the whole northwestern territory. Most of the gold from Alaska and the Yukon region comes here to the United States assay office.

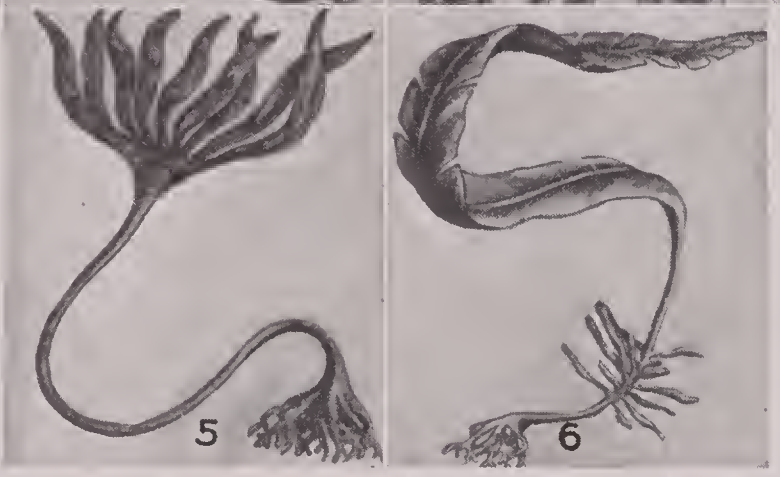
As proudly located as Rome on her seven high-crested hills, Seattle has had to sacrifice some of her beauty to convenience. She has regraded several of her picturesque hills by a hydraulic process—literally washing them away! But the city can never lose the superb views which meet the eye at every turn.

Seattle was named for an Indian chief. The first white settlement took place in 1852, and in 1889 a disastrous fire occurred. The city became the outfitting point for Alaska and the Yukon region when gold was discovered in 1897, and from that time on it developed rapidly. In 1909 the Alaska-Yukon-Pacific exposition was held in Seattle. The University of Washington occupies 355 acres within the city limits.

Seattle's mild though rainy climate and her pure water supply from the Cascade hills make it very healthful, with one of the lowest death rates in the world. Population, about 320,000.

SOME OF THE VARIED FORMS OF SEAWEED





1. The *Iridea edulis*, better known as Hide-Weed. 2. Carrageen or Irish Moss, an edible variety of the red seaweeds. 3. Rock weed (*Fucus vesiculosus*), one of the brown seaweeds. 4. Sea Lettuce (*Ulva latissima*), a green weed. 5. Deadman's Hand (*Laminaria digitata*). 6. Wingweed (*Laminaria esculenta*). Both the Deadman's Hand and the Wingweed belong to the group known as kelps.

SEA-URCHIN. This small sea animal, with its spiny shell, is closely related to the starfishes. There are many varieties of these interesting creatures found among the rocks along the seashores and on the ocean bottom. The common green sea-urchin (*Strongylocentrotus drobachiensis*) of the rocky New England and Pacific coasts is a round cushion-shaped creature with a shell of beautifully patterned limy plates underneath its thicket of spines. The smooth flat sand-dollar (*Echinarachnius parma*) is another familiar form found on sandy shores and admired for its curious markings. (*See* Starfish and Sea-Urchins.)

SEAWEED. A great floating meadow of seaweed—the famous Sargasso Sea—almost as large as a continent, lies in the North Atlantic Ocean, massed together by winds and ocean currents from the Caribbean Sea and Gulf of Mexico. It is a tangled fairy forest, the resting place for wandering albatross and petrel, and the home of tiny fishes, mollusks, crabs, jellyfish, sea worms, and other many-colored deep-sea creatures, which dart in and out, reminding us of Coleridge's lines—

> Blue, glossy green, and velvet black,
> They coiled and swam; and every track
> Was a flash of golden fire.

Through such masses of seaweed the ships of Columbus sailed for two weeks on his first voyage to the New World, and other enormous floating islands of seaweeds exist in the Pacific and Antarctic oceans. They are composed chiefly of the variety called "gulf weed," a long many-branched plant buoyed up by little air-bladders that look something like grapes. Many other kinds of seaweed are found all over the world, growing in both fresh and salt water. They are blue-green, green, brown, and red; and range in size from the little blue-green slimes found on ponds to the giant kelps, sometimes 150 feet long, with tough, leathery, rootlike branches.

They are useful as well as interesting and beautiful—these plants of the lakes and ponds and rivers and sea. Not only do they form breakwaters that prevent the wear and tear of waves on the coast, and sometimes make natural harbors; not only do they serve the useful purpose of throwing off oxygen and keeping the water pure; but they also form the real basis for ocean life, since the larger water creatures live on the smaller ones, which feed upon seaweed.

Kelp ash was formerly an important source of the alkalis used in manufacturing soap and glass, and the chief source also of iodine; but nowadays its chief value is as a fertilizer, since its rich potash content makes it a valuable enricher of worn-out soils. Many varieties of seaweeds, such as "Irish moss" or carrageen, are edible, containing a considerable proportion of gelatinous nutriment. Cattle and horses used to rough pastures thrive on it, and we also like it in blanc mange, and in jellies and soups. Many thousands of pounds of Irish moss are gathered at low tide along the rocky coasts of Ireland and Massachusetts Bay. When the tide rises the people go out in small boats and gather in the moss with rakes. Sometimes seaweed is used by upholsterers for stuffing mattresses, chairs, and couches; sometimes it is used in the manufacture of paper; sometimes it makes a kind of gelatin; and sometimes all sorts of little dolls and baskets and trinkets are formed out of dried kelp. The gigantic kelps along the northwest coast of America were once used by the natives for ropes, and the huge bladders, as large as kegs, served as water bags.

The term seaweed includes the simple kinds of algae, but not aquatic mosses, liverworts, fernworts, and flowering plants (*see* Algae).

SECRETARY BIRD. As snake killers, secretary birds are of great value in their native home of South Africa. They are protected by law and farmers often keep them about their premises to destroy vermin, for their diet includes frogs, insects, lizards, and small tortoises, as well as snakes.

Secretary birds (*Serpentarius secretarius*) were perhaps so called because of a tuft of quill-like feathers projecting from the back and sides of the head, making the profile view resemble that of a clerk or secretary with a number of quill pens behind his ear. They are also called "serpent eagles." The birds have very long legs and are about four feet high, with a tail that reaches the ground. The beak is strong and hooked, and the plumage a clear gray. They run with the speed of a horse, and when forced to do so will take to the air and fly to considerable heights. They build bulky nests in trees or bushes. The secretary bird forms a family by itself, related to the vultures.

MR. SECRETARY

The Secretary Bird is not as mild as his name might indicate. This one is toying with a snake, a delicacy of which the bird is very fond.

SEDAN, FRANCE. It was Nov. 7, 1918, four days before the armistice that ended the World War. American troops of the First Army, by the victorious battle of the Argonne, had cut the German communications and brought the town of Sedan under their guns. Now the doughboys of the "Rainbow Division" stood lined up by the roadside, ready to march across the Meuse and carry the Stars and Stripes into the town.

But before they entered, they sent ahead of them a column of French soldiers. The town of Sedan had for many years stood to France for a symbol of disaster. There, 48 years before, the last desperate battle of the Franco-Prussian War had been fought, in which Napoleon III and 86,000 men surrendered to the Germans. So by a fine act of courtesy the Americans allowed the French to enter Sedan first; and as the poilus in horizon blue passed the boys in khaki, the soldiers of both nations cheered and cheered again because of the wiping out of an old stain and the avenging of a nation's honor.

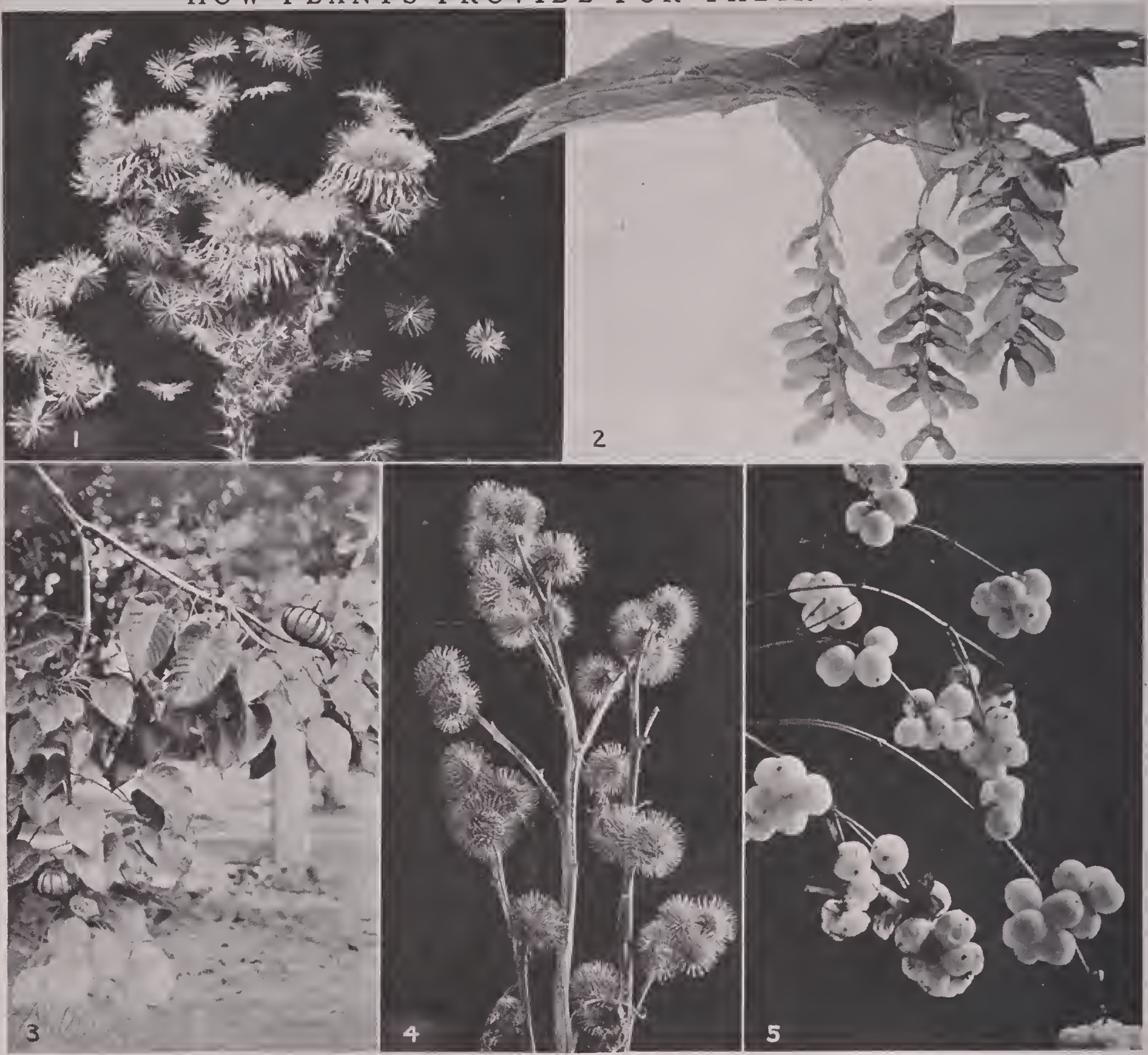
Sedan is a frontier fortress of France, on the right bank of the Meuse, 64 miles northeast of Reims. Within its stern fortifications in times of peace it manufactures cloth and machinery and flour, like a man in armor at a spinning wheel. Its name too is familiar in the name "Sedan chair," a sort of chair invented here to be carried on the shoulders of bearers, and once much used in Europe. The city has had a varied history since it was founded in the 14th century. Population, about 20,000.

SEDGE. The sedges are a large family of plants closely resembling the grasses and rushes, and are found thickly bunched in damp places. There are thousands of species, about 200 of which are found in North America. The sheath which enfolds the triangular stem is solid, while the grasses usually have the stem sheath split on one side. This difference is often the only feature by which the two can be distinguished. The spikelets of sedge flowers are small and inclosed by one scale instead of two, as is the case with grasses. In general the sedges are of little use to man, the coarse fodder being rejected by animals on account of the solid dry stems. The tubers of a few species are good to eat, while the fragrant roots of another are made into perfume. The generic name of the sedges is *Carex*.

SEEDS AND SPORES. Travelers in the West Indies are sometimes startled by a report like a pistol-shot, followed by a volley of large seeds rattling through the surrounding vegetation. And if one of the seeds should strike them at close range it would leave a mark they would be likely to remember the rest of the day. This is the effective way the sand-box tree, or "Monkey's dinner bell" (*hura*), takes to scatter its seeds so that when the new plants grow up they will not be crowded together on exhausted soil. Many other plants have such "sling-fruits," which burst violently when they are ripe and jerk the seeds out to a considerable distance. Examples are the wood-sorrel and pansy.

This explosive method is only one of the ways by which plants sow their seeds in fresh soil. Many

HOW PLANTS PROVIDE FOR THEIR YOUNG



Plants have scores of ingenious ways of scattering their seeds so that the next generation may start life in fresh and unexhausted soil. Some plants and trees, like the Carline Thistle (1) and the Striped Maple (2), trust to the wind to carry their seeds to fertile ground. The Monkey's Dinner Bell (3) is more energetic, perhaps because it lives in the warmer parts of South and Central America; its seeds are contained in separate capsules which explode with a loud report and are shot far away from the seed cluster. The Lappa or Burdock seeds (4) spread by sticking to animals, and the Bayberry (5) attracts birds which carry away the seeds sticking to their beaks or feathers.

seeds, or the fruits inclosing them, are especially adapted for transport by wind. The fruit of the basswood has a wing which acts like a parachute, sailing along with the breeze and carrying the fruit with it. Dandelions and thistles grow tufts of soft hairs, which float on the merest breath of air. Others have wings circular or paddle-shaped, like the elm-fruit or the "keys" of maple, ash, and tulip tree, which twirl in the air or fall like a stone according to their design. Other seeds are so light that they are blown about like dust. Again, the seed-heads, or even the whole plant, as in the tumble-weed, twists itself into a globular basket, inclosing the seed-pods, and rolls before the wind, carrying and scattering the seed broadcast over the countryside.

The fruits of many plants growing in or near the water are provided with life-preservers in the shape of air-filled coats, or bladder-like floats, to enable them to travel on the current. The tough shell of the coconut is water-tight and buoyant, and it drifts in the sea, uninjured, from tropical beach to beach.

Even birds and animals are compelled to act as seed carriers. Grasping hairs, barbed and sharp and hooked spines, fasten seeds to their coats "like burrs," or are trodden upon, and often are carried for long distances before the annoyed beast can rid itself of them. Mud dried on the shanks of water-fowl has its quota of small seeds.

It is to attract hungry creatures, especially birds, that seeds are often sunk in the flesh of luscious gaily colored fruits. Sometimes this is so sticky that the seeds are smeared on beaks to be wiped off and planted far away, as in the mistletoe; sometimes the seeds, as in the case of cherry pits, have coats so hard as to pass through the creature's digestive organs uninjured. On the other hand, these plant friends must be kept from attacking the young seeds and carrying them off before the proper time. This is done by many effective devices. The unripe flesh of edible fruits, for example, is too green and hard or sour to tempt; the thick husks of walnuts are filled with tannin; citrus fruits bear burning oils in their skins. Other fruits, or the bracts inclosing them, are armed with sharp prickles and spines, as we are painfully aware when we handle a chestnut-burr or a thistle-head. Moreover, the food provided within the seed for the infant plant is often rendered unpalatable by bitter and curious flavors, some of which we have come to like, as those of chocolate and coffee. Nutritious starches and useful oils and drugs are found there also, and even poisons. We must never forget that the little seeds of the spiked thorn-apple can kill.

To get an idea of how a seed is constructed, remove the coat from a bean or a pea. At once you will notice that the "embryo" or young plant within has two main parts which you can easily separate. These are called seed-leaves or "cotyledons," and their purpose is to provide nourishment for the young plant when it first emerges from its seed-coat and before it has had time to unfold its leaves and push its roots into the soil to secure its own food. Besides the cotyledons the embryo has other smaller parts which will develop into the roots, stems, and leaves of the mature plant. In some plants the cotyledons are too small to provide much nourishment to the young seedling. In those cases nourishment is furnished by the "endosperm," a starchy tissue which surrounds the embryo. Beans have no endosperm, but corn seeds show endosperm as well as embryo. If you examine a kernel of corn you will also be able to see that the little corn embryo has only one cotyledon instead of two. This difference is so important that botanists classify all plants with inclosed seeds (angiosperms) according to the way their seeds are made. Those with two or more seed-leaves are called "dicotyledons"; those with only one are known as "monocotyledons."

Difference between Seeds and Spores

Only the true flowering plants, the "spermatophytes," produce seeds. Most of the so-called "flowerless plants" or "cryptogams" reproduce by means of spores, which are merely little cells set apart for reproductive purposes. Unlike seeds, spores do not contain any young plant or embryo. In earlier days it was a favorite joke to send youngsters on Midsummer-Night's Eve to hunt for fern-seeds, by telling them that if the lucky finder put them in his shoe he would become invisible—as invisible as the elders thought the seed was, for they did not know that spores, hidden in the brown patches, or *sori* on the back of the frond, take the place of seeds. One type of spore, formed by the splitting of a cell in the parent plant, is called "asexual" and is borne in sporangia. The other type includes "zygospores" and "oospores" formed by the union of two sexual cells, in the latter case dissimilar and known as male and female cells, but having also many other names according to their origin and family, as well as many shapes. Some of the male cells can swim by means of hairlike tails, or "cilia," which thrash about. When an asexual spore from a fern germinates, it spreads into a thin green sheet, called a "prothallium." On these prothallia arise small structures, flask-shaped, known as "archegonia," in which lie the female or egg cells, which are to be fertilized by the ciliated male cells escaping from other receptacles called "antheridia," carried by drops of rainwater. The fern plant which we know springs from the fertilized egg-cell and itself raises asexual spores. This roundabout process is called the "alternation of generations" and is followed by other cryptogams as well. (*See* Ferns; Fungi; Liverworts; Moss.)

SEINE (*sān*) **RIVER.** Foremost in historic interest of the rivers of France is the Seine, made world famous through the development of Paris on its banks. It rises from six little springs in a wooded rocky dale among the hills of the old duchy of Burgundy in eastern France and, after winding and twisting its way northwestward through a course of 482 miles, falls into the English Channel between the ports of Honfleur and Havre. In a direct line the source of the Seine is only 250 miles from its mouth, but the river doubles back and forth, curving and recurving upon itself until it consumes almost twice that distance. Gliding beneath the shade of overarching willows and tall poplars, it flows through a beautiful country rich in memories of bygone times, and abounding in relics of present and departed greatness. Battlegrounds of the Romans, the Vikings, and the Normans, ancient palaces of kings, grim feudal castles and medieval monasteries, intermingled with stately mansions of today and widespreading forests, lie along its course. Before reaching Paris about 230 miles from the mouth, it passes such famous cities as Melun and Fontainebleau, while below the great metropolis St. Denis, St. Germaine, and Rouen are situated on its banks.

The Seine near its source is a puny rivulet that sometimes in summer becomes quite dry. Sustained by small tributaries, however, it increases to a vigorous brook, and farther on, as it receives in turn the waters of the Aube, the Yonne, the Oise, and the Marne, it develops into one of the four important rivers of France, furnishing water-power for numerous large industries. It is navigable for small vessels for some distance above Paris. The low elevation of the hills which bound its basin makes it comparatively easy, moreover, to connect the Seine and its tributaries, by means of canals, with the Somme, the Scheldt, the Meuse, the Saône, and the Loire. Deep dredging from its mouth to Rouen, a distance of about 50 miles, has made that city a seaport and has reclaimed 28,000 acres of land. In the World War the farthest advance of the Germans, in 1914, touched the Seine about 100 miles east of Paris.

SELENIUM. A photographer in New York takes a picture of a passing parade, and hastens to his dark room. Here he prepares a print, and takes it to a nearby laboratory, where it is placed in a curious machine. The machine commences to work—and at the same moment another machine in San Francisco with which it is connected by telegraph starts also. When both machines stop, the second has produced a duplicate of the picture which was placed in the first. The two machines have "telegraphed" the picture taken by the photographer.

Such marvelous achievements are made possible by a curious property of the element selenium. This substance conducts electricity—and the more intense the light which falls upon it, the better conductor it is. In order then to "telegraph" a picture, it is only necessary to expose it bit by bit to a beam of light, and then to make this light fall on a piece of selenium sometimes called the "eye." When a dark place comes in the picture, only a little light falls on the selenium and its conductivity is low. A light spot increases the conductivity. These varying currents are transmitted to a lamp in the receiving machine, and its varying light is allowed to fall on a plate which is being moved by machinery in exactly the same way that the original picture is moving. The spots varying light and dark build up a duplicate of the original picture. The method has even been adapted with some success to transmission by wireless instead of telegraph.

Selenium was discovered in 1817 by the Swedish chemist Berzelius. Ruhmers, a German scientist, used selenium in making a telephone with which he could talk over a ray from a searchlight. It has been used on safes and vaults in such a way as to give an alarm when the burglar turns his light upon it. One of its most interesting applications is in the phonopticon, a device for making light waves produce sound (*see* Light). Chemical symbol, *Se;* atomic weight, 79.2.

SENSITIVE PLANTS. All plants are more or less sensitive, that is, able to respond to stimuli. Some plants, however, respond so quickly and so evidently that they have been popularly called sensitive plants. Conspicuous among them are species of mimosa, acacia, and their allies, members of the pea family. These plants have large compound leaves composed of numerous and very small leaflets. At a sudden touch the paired leaflets fold together, or the whole leaf may fold up and its petiole droop. In the natural surroundings of these plants this folding of the leaves has to do with the avoidance of too intense light or drought, the surface of exposure thus being diminished in exact proportion to the need. (*See* Compass Plants; Plant Life.)

MAN'S *Most* USEFUL TOOL *of* SPEECH—*the* SENTENCE

What We Mean by "Subject" and "Predicate," "Phrases" and "Clauses"—The Various Kinds of Sentences and Some Common Mistakes in Their Use

SENTENCE. A sentence is a group of words expressing a complete thought, and it is one of man's most common and useful tools. We use sentences almost every hour of every day. But a speaker or writer who makes a sentence must have something to think about, and he must single out some fact concerning it which interests him especially, and assert that fact or ask a question about it. For example, suppose he is thinking about water. If he is going in bathing he is especially interested in its temperature, so he asserts, perhaps, "The water is cold." If he doesn't know whether it is cold or not, he might put his thought in the form of a question: "Is the water cold?" Under other circumstances he might think of the color, and exclaim: "How blue the water is today!"

Now, the part of the sentence that represents what is talked about is called the *subject.* All the rest of the sentence, which asserts or *predicates* something, is called the *predicate.* In all the sentences above, the words *the water* are the subject; the predicate is all the rest of each sentence.

The complete subject of the sentence always contains a noun or a pronoun, or a group of words used like a noun, which stands for the thing talked about. This is called the *subject substantive.* It may or may not have adjuncts or modifiers. In the sentence "People who live in glass houses mustn't throw stones," the word *people* is the subject substantive. It has as a modifier the clause *who live in glass houses,* showing which people are meant. The *complete* subject is the words "*people who live in glass houses.*"

That Much-Needed Verb

The predicate of a sentence must always contain a verb (*see* Verb). Sometimes this verb by itself says all we want to say about the subject; as "The water *boils.*" But often we want to add to the meaning of the verb, to make it clearer and more definite; as "Water *boils more rapidly if you make the fire hotter.*" And again, certain verbs require other words to complete their meaning. Linking verbs, such as *be, become,* take a *predicate* noun, pronoun, or adjective to complete their meaning. Transitive verbs, that is, those that express an action as affecting someone or something other than the subject, must have an *object.* This object may be one word or a group of words; as, "The water burned *me*"; "He said *that the water was cold.*"

Any or all of these necessary or essential elements of the sentence may be made more clear and interesting by the use of modifiers or adjuncts added to them; as, "The water *in the large kettle* is *not* boiling *yet, though the fire is hot*"; "The water *in our pond* is *still too cold for comfortable bathing*."

These modifiers are either single words, phrases, or clauses. A *phrase* is a group of words not consisting of a subject and predicate, and used like an adjective, an adverb, or a noun; as, *under the tree, finding gold at the rainbow's end, to stay here*. A *clause* is a group of words consisting of a subject and predicate, combined with another such group to make a single sentence. For example, "I came, I saw, I conquered" is a sentence consisting of three clauses, each of which might stand by itself as a single complete sentence.

The Part the Clauses Play

Clauses which are of principal and equal importance in the sentence are called *coördinate* clauses. Clauses which are dependent on some other member of the sentence are called *subordinate*. Subordinate clauses may be used like adverbs, to define the meaning of the principal verb ("I shall come *when I am ready*"); like adjectives, to define the meaning of a noun or pronoun ("This is the house *that Jack built*"); or like nouns ("He told me *what I wanted to know*").

According to form, sentences are *simple, compound*, or *complex*. A *simple* sentence is a sentence that consists of one proposition. Either its subject or its predicate or both may be compound, as: "*Bread* (and) *potatoes* are starchy foods"; People *need certain food elements* (and) *usually enjoy the proper combinations of these*": *Both men* (and) *animals require abundant fresh air* (and) *weaken in confinement*."

A compound sentence is a sentence that consists of two or more independent propositions or clauses, as: "I came, I saw, I conquered." Propositions should not be joined in a compound sentence unless they are closely related in thought. "John is captain of our baseball team, and the North Pole has been discovered," though from one point of view correct grammatically, is not a real sentence, since it is not the expression of a single thought. The members or parts composing a compound sentence are usually joined by a coördinating word called a conjunction (*see* Conjunction).

A *complex* sentence is a sentence consisting of a main proposition or clause and one or more subordinate clauses; as, "Wait *till he comes*." "Between the dark and the daylight, *when the night is beginning to lower*, comes a pause in the day's occupations, *which is known as the children's hour*."

Now in nearly all the sentences we have talked about so far, the predicate states or *declares* something about the subject. For that reason we call such sentences *declarative* sentences. But there are also three other kinds of sentences, distinguished according to meaning. There is the kind that asks a question; as, "Is Buenos Aires the largest city of South America?" These question-asking sentences are called *interrogative* and always end with a question mark (?). Another kind of sentence commands someone to do something; as "Everybody come in!" We call this sort of sentence *imperative*, and often put an exclamation point (!) after it. Then there is a fourth kind of sentence that we use when we want to express strong feeling about something. For example, if you are surprised to wake up in the morning and see a heavy fall of snow you exclaim, "What a lot of snow has fallen!" Such a sentence is called *exclamatory*, and always has an exclamation point after it.

Some very common mistakes in writing are due to vague notions about the difference between a sentence and a clause or phrase. Two or more separate sentences are often incorrectly written as if they were one sentence; as, "The trees by the pond are bare now, they are maples and willows." And, on the other hand, uneducated persons will sometimes treat a part of a sentence as if it were a sentence by itself; as, "He was well satisfied with the returns in health and good fellowship. Though he lost money by the undertaking."

SEPTEMBER. The name of this month comes from the Latin word meaning seven, and it was the seventh month of the Roman calendar (beginning with March). September is the ninth month according to our reckoning. It has always had 30 days. It is preëminently the harvest month, and in it occurs the autumnal equinox (*see* Equinox and Solstice).

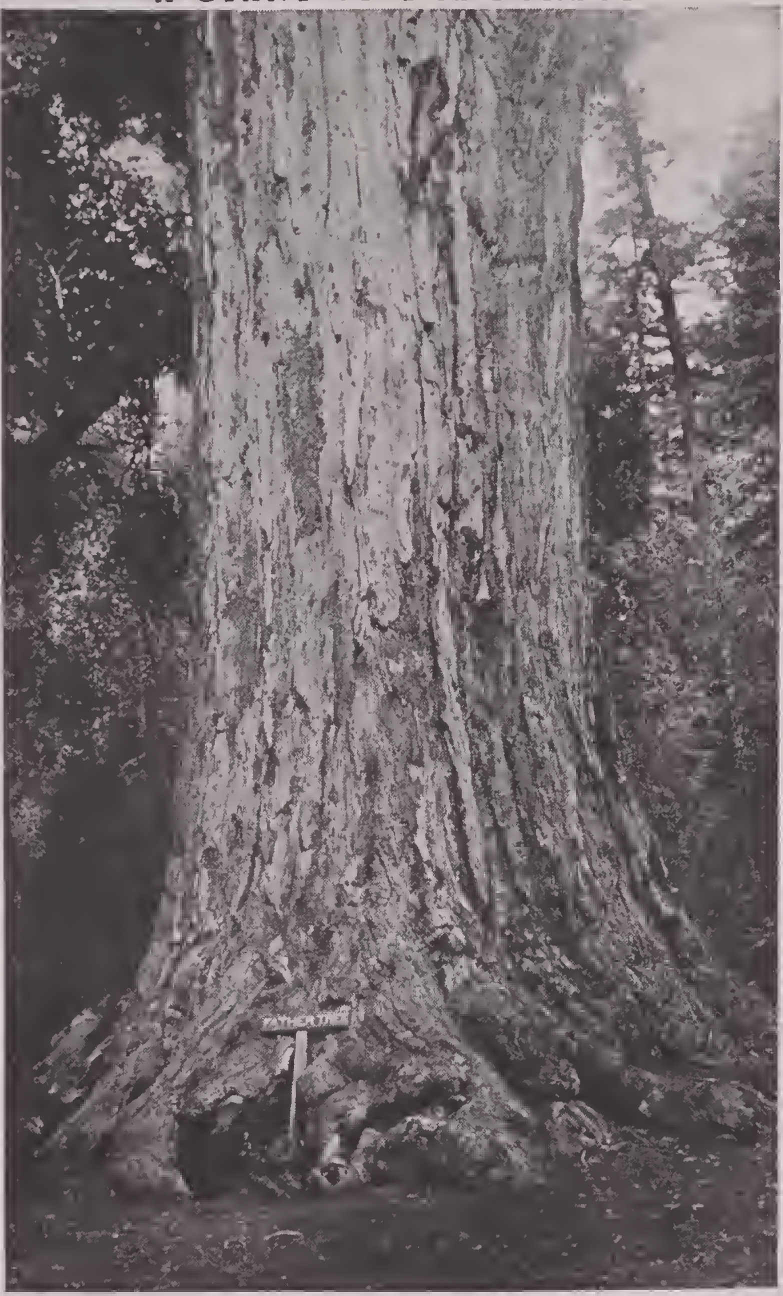
SEQUOI'A. No work of nature is more majestic or more awe-inspiring in its way than the gigantic evergreen sequoia trees of California, the largest and perhaps the oldest of all forest trees. They are of two species, the "big trees," or Washington sequoia, found only on the western slopes of the Sierra Nevada range, whose massive grandeur brings to them thousands of visitors each year, and the redwoods of the Coast Range, which furnish one of the most valuable timbers of the Pacific coast.

Groves of the "big trees," the last survivors of a very ancient and very wonderful family, are carefully preserved in state and national parks. One author says of them: "In stature they are imposing as no other living thing; in age they are a measure for the centuries; in situation they are stranded on the flanks of a mountain range where they are able neither to retreat nor to advance; and in number they are comparatively few." These remarkable giants grow from 200 to 400 feet high, with an average diameter at the ground of 20 feet. They have a bright cinnamon-colored fluted trunk, which often rises branchless to a height of 180 feet. The crown is narrow and dome-shaped, clothed in long sharp-pointed evergreen foliage, from which hang small scaly reddish-brown cones. The tops of the very old trees are much broken from the weight of snow and windstorms. From the annual rings in the wood the age of the largest trees yet felled is known to be from

1,100 to 2,500 years. Many writers believe that some of the still surviving giants are from 5,000 to 8,000 years old.

One of the most famous big trees is the Grizzly Giant in Mariposa Grove, a part of the Yosemite National Park. At the ground it is 93 feet in diameter. Its royal crown has been shattered and its body stripped nearly bare by the centuries of storms through which it has passed. Another mighty tree has a tunnel through its base through which stagecoaches drive. Through the fallen trunk of another is a roadway 90 feet long, through which a man may ride on horseback. You may get some idea of the enormous amount of timber contained in one of these giants from the fact that a single tree would furnish enough to encase the great steamship *Lusitania,* torpedoed in the World War, or to box up the Masonic Temple in Chicago.

A GIANT OF THE FOREST



This is an old "Sequoia Gigantea," with a diameter of 26 feet. The bark of the tree is spongy and deeply wrinkled, and often as much as two feet thick. The trunk tapers very gradually and usually has no branches within 100 feet of the ground. The Giant Sequoia is native only to California.

The dark red wood of the "big trees" is light and extraordinarily durable, and in the past thousands of them have been lumbered. Since they have come under the protection of the state and nation, however, their commercial use is limited, and it is left largely to the redwood trees, which are much more plentiful, to supply the sequoia family's contribution of timber. This they do royally, and someone has said: "California might have spared her gold mines, but not the resources of the redwood belt."

The redwoods, which thrive only in the fog drenched forests near the coast, are really a younger growth of the "big trees," which they closely resemble. Their chief difference lies in their method of reproducing, for the "big trees" reproduce exclusively from the cones, while the redwoods also send up suckers to form new trees. Their foliage, which has a reddish-brown tinge, lies in flat sprays, and the cones are borne in clusters, usually in the top of the tree. The wood is light, straight-grained, and easily worked, and when properly dried does not shrink or warp. It is very slow to burn, because it is wholly free from resin, and in contact with soil will last for centuries without rotting. Hence it is valuable for house-building, telegraph poles, railway construction, bridges, etc. Many of the bungalows so characteristic of California are built of redwood, and in communities where it is largely used, the fire hazard is far less than in cities where resinous pine or fir prevails. For certain water supply conduits in engineering projects redwood has been found superior to steel, and many new uses are constantly being discovered for it.

Scientific name of the "big tree," *Sequoia gigantea.* Bark red, fibrous, from $1\frac{1}{2}$ to 2 feet thick, broken into longitudinal wrinkles or furrows. Leaves awl-shaped, 1 to 6 inches long. Cones maturing in second autumn, 2 to $3\frac{3}{4}$ inches long, composed of 35 to 40 scales. Scientific name of redwood, *Sequoia sempervirens.* Height 100 to 340 feet, trunk 2 to 16 feet in diameter. Crown narrow, branches horizontal or sweeping downward.

SERBIA. In the 14th century Serbia was mistress of the greater part of the Balkan peninsula from the Danube to the Gulf of Corinth. A century later she was the vassal of the Turk, and her people were sold as slaves in the markets of Constantinople. In the 19th century she was freed from Turkish rule and grew in economic and political strength; and in the Balkan Wars of 1912–13—the first fought against Turkey and the second against Bulgaria, her former ally—she just about doubled her territory. Her people cherished dreams of restoring the "Greater Serbia" of their golden age; but up to the outbreak of the great World War of 1914–18, Serbia remained a peasant kingdom of small farmers. Though terribly ravaged by Austrians and Bulgars in that conflict, the Serbians held out dauntless to the end. They reaped their reward in the reunion of the whole of the South Slav race in the "Kingdom of the Serbs, Croats, and Slovenes." (*See* Jugo-Slavia.)

Most of the farmers use clumsy wooden carts drawn by oxen or buffaloes. The Serbians, like all mountaineers, are fierce fighters in war, but they are kind and hospitable in peace. The first farmer you meet will offer you a seat in his cart and is glad to share with you the shelter and the simple table fare of his home, which includes corn cakes three times a day. The mother of the household will bring out her delicious plum marmalade which the Serbians make and export; for plum orchards are to the Serbians what apple orchards are to us.

In the more primitive regions are still found "zadrugas," or community groups of families related to one another, living in separate cottages but having a large building in common in which they eat and spend the evenings.

The little farms of today seldom exceed 20 acres. A Serbian farmer cannot lose all his possessions under a mortgage as an American farmer can because the law will not allow him to give, or another to take, a mortgage covering more than a certain proportion of his land. His cottage he cannot mortgage at all—nor his garden, his plow, or the cattle necessary to draw the plow or haul his products to market.

There are no very rich people, neither are there any very poor ones. There are practically no paupers and there are no poorhouses. The people are not so thrifty nor so industrious as the Bulgars, nor so clever as the Rumanians. Comparatively few are engaged in manufactures, for the Serbian feels that he forfeits his independence by working in a factory. There are some meat-packing plants, flour mills, breweries, iron foundries, potteries, sugar, tobacco, and celluloid factories, and mills for weaving hemp, flax, and wool, but the workers are mainly foreigners. There are a few home industries including spinning, the making of corded sandals such as peasants wear, and handwoven carpets and rugs. They also export native wines, mainly to France and Switzerland. A serious drawback to the commercial development of Serbia before the war was the lack of seaports, which placed the country at the mercy of hostile tariffs. In the new Jugo-Slavia this lack is remedied.

The area of Serbia is about 42,100 square miles, and the population about 5,000,000. Besides Belgrade, the capital, the important cities are Nish, Prisrend, Uskup, and Monastir. The Serbian religion is the Greek Catholic, and the Cyrillic alphabet (similar to the Russian) is used.

The Serbians first settled in their land in the 7th century. The Turkish rule began with the defeat of the Serbians in the great battle of Kossovo in 1389, and was maintained with such cruelty that many Serbs emigrated to southern Hungary. After more than four centuries of tyranny, a group of Serbian patriots organized a rebellion and elected George Petrovitch (called Kara-George or Black George) as their leader (1804). They recovered the district about Belgrade, but were soon forced to flee from the Turkish forces sent against them. In 1815 a second rebellion was organized by Milan Obrenovitch, who succeeded in establishing the autonomy of the Belgrade government (1829) and proclaimed himself hereditary prince. When Kara-George returned to Serbia he was assassinated by Milan's orders. The next half-century was spent in feuds between the rival houses of Kara-Georgevitch and Obrenovitch, and attempts to free more Serbian territory from the Turks. The long struggle ended in 1878, when, following the Russo-Turkish War, complete independence was conferred upon Serbia by the Congress of Berlin. In 1921 the present king, Alexander, succeeded his father Peter I, of the Kara-Georgevitch family, who came to the throne in 1903 following the political assassination of King Alexander and Queen Draga of the rival dynasty.

Unfortunately Serbia blocked the "corridor" by which Austria-Hungary hoped to reach the Aegean and dominate the Balkans. The result was the series of events which led to the Austrian ultimatum of July 23, 1914, and the World War. (*See* World War of 1914–18.)

The "SEVEN WONDERS" *of* ANTIQUITY *and of* TODAY

Man's Triumphs as a Builder—The Pyramids, Sole Survivors of the Mighty Seven—Babylon's Hanging Gardens, Olympian Zeus, Diana's Temple at Ephesus, the Mausoleum, the Rhodes Colossus, and the Pharos Light

SEVEN WONDERS OF THE WORLD. Of the marvelous works built in ancient times the sightseers of the time of Alexander the Great selected seven as the most wonderful. These were variously listed, but a list found in a little treatise of about the 6th century A.D. gives the following: (1) the Pyramids of Egypt; (2) the Hanging Gardens of Babylon; (3) the Statue of Zeus at Olympia; (4) the Temple of Diana at Ephesus; (5) the Mausoleum at Halicarnassus; (6) the Colossus at Rhodes; (1) the Pharos (lighthouse) at Alexandria. The world has learned much about engineering and architecture, but we still marvel at the massive Pyramids, which stand as solid as ever after the wear and tear of centuries (*see* Pyramids). Except for fragments of the Mausoleum and the Temple of Diana, they are the only "wonder of the world" that remains today.

The Hanging Gardens of Babylon have long since disappeared. They were said to have been built by King Nebuchadnezzar (about 660 B.C.) to please his favorite wife, who had come from a hilly land and wearied of the flat plains of Babylon. Great terraces of masonry, from 75 to 300 feet in height, were built one on top of the other, and on these were planted gardens of gorgeous tropical flowers and groves and avenues of palm trees, irrigated by water pumped from the Euphrates River. On these "roof gardens" Nebuchadnezzar and his queen could sit in the cool shade and look down upon the beauties of the city.

The Statue of Olympian Zeus was erected at Olympia, in the Peloponnesus of Greece, by the great sculptor Phidias, in the 5th century B.C. It was a towering structure of ivory and gold, 60 feet high, no less remarkable for its majesty and beauty than for its richness and size. It has utterly perished, and our only idea of it is gained from coins of Elis which are said to bear copies of the great original. (*See* Phidias; Zeus.)

Recent excavations on the site of the ancient Greek city of Ephesus, in Asia Minor, have revealed fragments of the pavements, columns, and sculptures of the magnificent Temple of Diana. Their workmanship is so superb that it is easy to see why the ancients regarded the temple as one of the wonders of the world. The first Greek settlers at Ephesus found the Asiatic inhabitants worshiping a many-breasted nature goddess, whom they identified with their own Artemis (called Diana by the Romans). They raised a shrine to her, which was rebuilt and enlarged from time to time. The fourth temple is the one regarded as the "Wonder." It is said to have been built by contributions from all the great cities of Asia and to have taken 120 years to complete, being dedicated about 430 B.C. This great structure, alas! was set on fire in 356 B.C.—on the very night when Alexander the Great was born, it is said—by one Herostratus, who committed this crime merely that his name might be remembered in after ages!

A new temple of Artemis was completed before the end of the century, and it stood until 262 A.D., when it was sacked and burned by the Goths. The great sculptured drums of the lower part of its 60-foot columns, now in the British Museum, indicate that the fifth temple was inferior in workmanship to the fourth. Both were embellished with priceless statues and paintings. They were among the largest Greek temples ever built, the fourth measuring 425 feet by 220—which is larger than the famous St. Peter's Church at Rome (613 feet by 87). The fifth temple was still larger. After the edict of Theodosius (381 A.D.) which closed the pagan temples, the ruins of these ancient structures were used as materials for the construction of Christian churches. Two of the pillars in the great cathedral of Pisa, and the green jasper columns supporting the dome of St. Sophia's in Constantinople, are said to have been taken from the Temple of Diana.

Famous Tomb of King Mausolus

The Mausoleum at Halicarnassus—also in Asia Minor—derived its name from King Mausolus of Caria, who died about the middle of the 3d century B.C. His wife, who was devoted to his memory, employed Greek architects and sculptors to construct and decorate, at Halicarnassus, this superb monument over his remains. It was a great rectangular pile of masonry, surmounted by an Ionic colonnade which supported a roof-like pyramid. At the apex of this pyramid stood a magnificent four-horse chariot, in which were statues of the king and queen. So famous did it become that the word "mausoleum" is now applied to any monumental tomb. Some of the remains of the original Mausoleum are now preserved in the British Museum.

The Colossus of Rhodes was a huge statue of the sun god Helios (or of Apollo), erected in 280 B.C. at the entrance of the harbor of Rhodes, an island in the Aegean Sea near the southwestern coast of Asia Minor. It was built of bronze and was more than 100 feet high. According to the usual belief it stood astride the entrance and it is often so represented in pictures; but as a matter of fact it probably stood at one side of the entrance. It was overthrown by an earthquake in 224 B.C., and after almost a thousand years, the remains were sold for old metal.

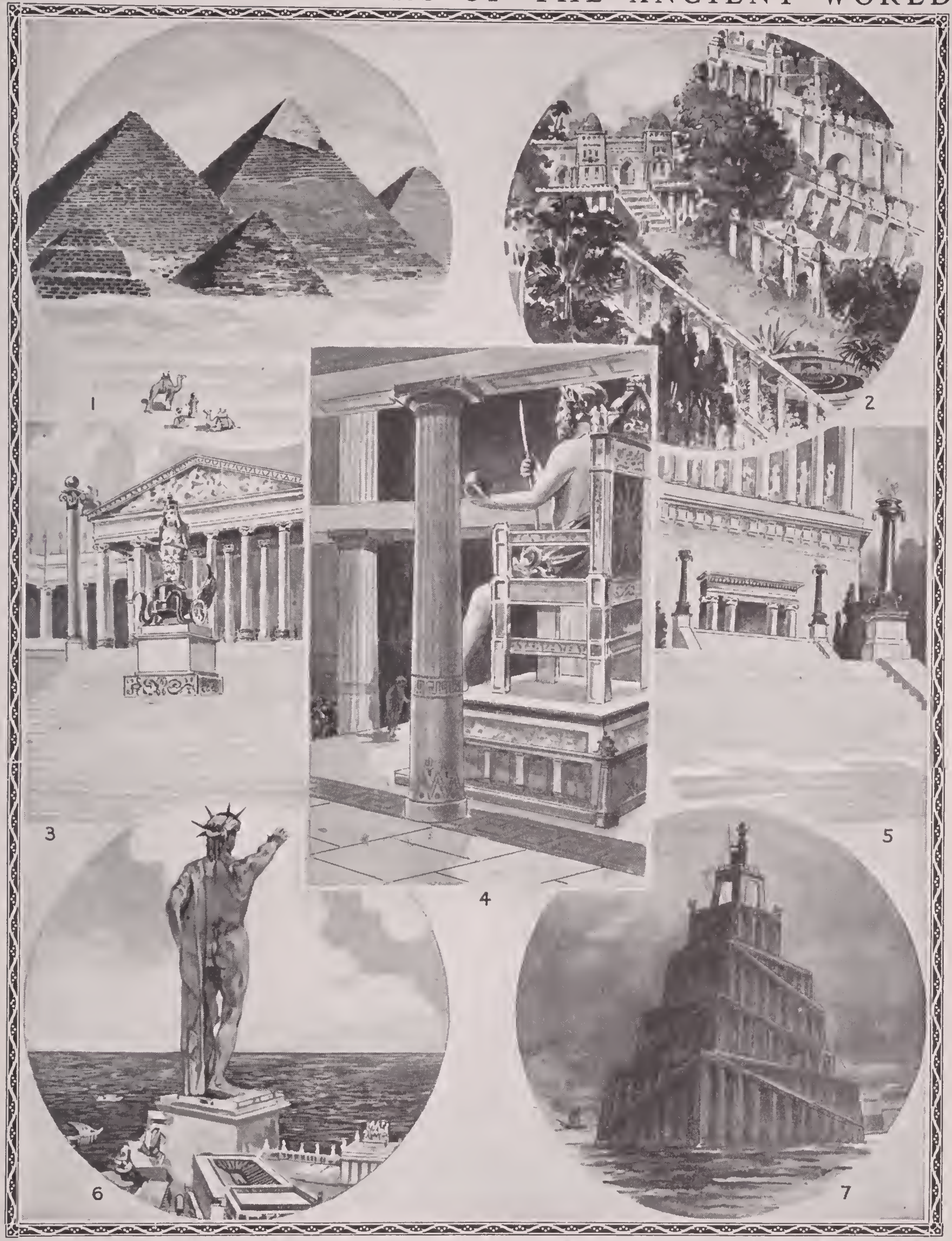
The Pharos of Alexandria, in Egypt, was the forerunner of modern lighthouses. The name belonged originally to an island lying off the coast. When Alexander the Great laid out this city to which he gave his name, he connected the island of Pharos with the mainland by means of a "mole" or causeway. On the eastern point of the island Ptolemy I and Ptolemy II, Greek kings of Egypt who followed him, erected a great lighthouse of white marble, said to have been 400 feet high; and it was this structure which came to be known as "the Pharos of Alexandria."

But What were Those Days to Ours?

Amazing as were these wonders of the ancient world, they pale before the wonders of modern times. The Pyramids, mighty as they are, are equaled by such structures as the locks of the Panama Canal and the great dam at Assouan, which England built to store the waters of the Nile. The Hanging Gardens of Babylon, the Mausoleum, the Ephesian temple, and the Pharos sink into insignificance before the skyscrapers and public buildings of to-day.

But the real "wonders" of today are the amazing and beneficent triumphs of modern scientists over Nature, — their discoveries and inventions which enable man to fly like the birds, to talk thousands of miles without wires, to baffle disease, and perform every day and every hour feats which exceed the wildest imaginings of the ancients. So we may list as the "Seven Wonders" of the modern world its seven greatest scientific achievements. Some time ago an American magazine took a vote of its readers as to what these seven modern wonders are. Here is the list that was chosen: (1) Wireless Telegraphy, (2) the Telephone, (3) the Airplane, (4) Radium, (5) Anesthetics and Antitoxins, (6) Spectrum Analysis, and (7) X-rays. If you will turn to the articles which deal with these subjects, and let your mind dwell on the marvels in each of these achievements, you will see that these modern "wonders" are no less wonderful than those of the ancient days.

THE SEVEN WONDERS OF THE ANCIENT WORLD



1. First of them all, because they have survived to our own day, are the Pyramids of Egypt. 2. The Hanging Gardens of Babylon were built by Nebuchadnezzar to gratify one of his wives. 3. The Temple of Diana at Ephesus, larger than St. Peter's in Rome, was one of the largest temples ever built. 4. The Statue of Jupiter on Olympus was the master work of the sculptor Phidias; the figure of the god was carved from ivory, and the drapery was solid gold. 5. The tomb of King Mausolus at Halicarnassus in Asia Minor was so superb that the name "mausoleum" has ever since been given to monumental tombs. 6. The Colossus of Rhodes, 100 feet high, guarded the entrance to the harbor of Rhodes. 7. The Pharos of Alexandria was a lighthouse 400 feet high, on whose summit burned night and day a beacon fire.

SEVEN YEARS' WAR (1756–1763). When Frederick the Great of Prussia, in 1740, seized the Austrian province of Silesia, he, like the youth who murdered the Austrian archduke at Serajevo in 1914, set off a powder mine that had been laid by the world-wide rivalries of European powers and alliances. The struggle spread from Austria and Prussia to all Europe, and finally burst over the whole world from the Indian rajahs of Hindustan to the European colonists of Canada and New England. For more than a score of years the quarrel disturbed the peace of Europe. In the War of the Austrian Succession (1741–1748)—called by Germans the first two "Silesian" wars—Maria Theresa, the courageous young ruler of Austria, made two vain attempts to recover her stolen lands (*see* Maria Theresa). There was next a breathing spell of eight years. Then in 1756, having won new support among the powers of Europe, she decided to try a third time; but before she and her allies could strike a blow, Frederick the Great, learning of their intentions, invaded the neutral but unfriendly land of Saxony, and so himself began the third Silesian or Seven Years' War.

Since the beginning of the quarrel over Silesia there had been a general shift in the relations of the nations of Europe. In the War of the Austrian Succession Great Britain had taken up arms on the side of Austria, while France had fought alongside Prussia. But when the conflict began in 1756 a "diplomatic revolution" had brought a reversal of alliances. With Prussia was now allied her old enemy, England; for William Pitt, who was now in control in England, saw more clearly than did the stupid George II, with his Hanoverian prejudices, that the second "hundred years' war" between France and England for colonies must be won in Europe. Kaunitz, a young minister of Maria Theresa, also looked at old questions with new eyes. He persuaded her to forget the old French (Bourbon) and Austrian (Hapsburg) rivalry extending over 250 years, and to seek aid in France against her real enemy, the rising power of Prussia. France—or rather Madame Pompadour, Louis XV's favorite—listened, hesitated, and then joined Austria.

The League of the Three Petticoats

On the one side there was Austria, Russia, and France—"the League of Three Petticoats" (Madame Pompadour, Maria Theresa, and Empress Elizabeth of Russia), as it was sneeringly called. On the other was Great Britain with its navy and Prussia with its well prepared army, plus Pitt's statesmanship and Frederick's military genius.

At the outbreak of the war Frederick made himself master of Saxony by the defeat of the Austrians, temporarily invaded Bohemia, and again inflicted defeat upon the Austrians (at Prague, May 1757). Later in the year he defeated the French and his German enemies in the most famous, perhaps, of his battles—at Rossbach. A month later (December 1757) he routed the Austrians at Leuthen. Through the varying fortunes of the two succeeding years, Frederick's military genius enabled him, despite desperate situations when he was ringed about by hostile Russian, French, Swedish, and Austrian armies on Prussian soil, with Berlin occupied and plundered, to wrest victories from his enemies and hold the balance even in Europe, while Pitt directed the forces of England to triumph in America and India. Then George III came to the English throne, in 1760. The genius of Pitt made him uncomfortable. The great minister was forced to resign in 1761, and shortly afterward the money subsidies which England had been paying to Frederick ceased. Frederick's straits were somewhat relieved in the following year, when Elizabeth of Russia died and Peter III, her successor, in his few months' reign made peace with Prussia. Sweden and France fell away from the alliance, and finally Austria, too weak to carry on the war alone, made peace with Prussia at Hubertsburg (Feb. 15, 1763). The map of Europe was not changed by this peace, for Silesia was confirmed as a possession of Frederick.

A War on Three Continents

The war, as has been said, was not confined to Europe. In America the conflict had begun the year before it broke out in Europe, and was known as the French and Indian War (*see* French and Indian War). Here the struggle went against France, and in the end she lost all of her American possessions.

In India English prowess met with like good fortune. The East India Company had founded settlements for trade, which gave promise of extending to an empire; but France, jealous of her hereditary rival, endeavored to snatch the prize. Dupleix, the able French governor of Pondicherry, captured Madras, and by intriguing with the native princes attempted to make French power supreme over the country. In this ambitious scheme he was checkmated by the stupidity of the corrupt French court, which sent him no support, and by the genius of Robert Clive, who from a clerkship in the East India Company rose to be one of the greatest of English generals and the founder of British rule in India (*see* Clive, Robert). The prolonged and desperate struggle in America and in India ended by the Peace of Paris, a few days before the treaty which closed the conflict in Europe (Feb. 10, 1763). France ceded to Great Britain the whole of Canada, together with various islands in the West Indies. The captured French trading stations in India were restored but were not to be fortified. Spain, which had been drawn into the war on the side of France, ceded Florida to England (which held it until 1783), while France compensated Spain with the cession of the Louisiana country west of the Mississippi.

It is not too much to say that the Seven Years' War was a turning point in the world's history. Prussia emerged triumphant and stamped with the military prestige and doubtful diplomacy of Frederick. The Prussian-Austrian struggle for leadership in Germany was now fairly begun. France, shorn of her colonies and with diminished prestige in Europe, was headed for revolution unless vigorous reforms saved her. Great Britain had acquired a world empire on which the sun never set. The colonies in America had a new conception of their own power and place in the British Empire, and George III was blindly confident that the glories of England's triumph gave the king new power and prestige. The future clash between colonists and the mother country was inevitable.

SEVIER (*sĕv-ēr′*), JOHN (1745–1815). When in 1780 a band of about a thousand American frontiersmen charged again and again up King's Mountain, N.C., and finally defeated the British, their right wing was led by John Sevier, a frontiersman and Indian fighter of eastern Tennessee. Of the many courageous men who aided in winning the region beyond the Appalachian Mountains, Sevier is by far the most dashing figure. He was not, like most of these men, a crude uneducated frontiersman, but was an educated "gentleman," who traced his ancestry back several generations to a French Huguenot family named Xavier. He was born in Virginia, married at the age of 17, and at the age of 19 founded the settlement of New Market in the Shenandoah valley, where he became a celebrated Indian fighter. In 1772 he removed beyond the Alleghenies to the Watauga settlements, in land claimed by the colony of North Carolina. His learning and bravery made him the natural leader of the people of that district, and they turned to him in all emergencies. They learned anew his fighting ability when he served as captain in 1774 in "Lord Dunmore's War," the name given to the expedition which that governor of Virginia led against the Indians on the Ohio; and again when, during the Revolution, he was one of "Marion's men," and was made a brigadier general.

So, when the people of western North Carolina (Tennessee) revolted in 1785 and formed a separate state, which they named "Frankland" or "Franklin," they elected Sevier its first and only governor. After a three years' struggle with the state of North Carolina, "Franklin" ceased to exist. Sevier for a time was imprisoned by the North Carolina authorities, but escaped. He was then allowed to take his seat as a member of the North Carolina senate, and in 1790 was sent to Congress. When Tennessee was finally made a separate state, he served as its first governor, 1796–1801, and again in 1803–09. At the time of his death he was a member of Congress, having been sent there again in 1811, and was engaged in negotiations with the Creek Indians of the south.

SÉVIGNÉ (*sā-vēn-yā′*), MADAME DE (1626–1696). Here was a beautiful, brilliant, warm-hearted woman whose remarkable correspondence with an absent daughter has made people call her "the queen of letter-writers." She was born in Paris, and her maiden name was Marie de Rabutin-Chantal. She grew up to be a lovely, fair-haired, bright-eyed girl, with a velvety skin and graceful ways. At 18 she married a spendthrift marquis, who managed to be killed in a duel, leaving her with a son and a daughter. All the fashionable circle in which she moved admired her beauty, her delightful conversation, and her kind generous heart. It was almost too kind and generous, and poured out far too ardent an affection upon her little boy and girl, who, it must be admitted, grew up into selfish, weak, snobbish creatures, although the daughter did inherit her golden-haired mother's fair face.

When this girl married the Count of Grignan, lieutenant-general of Provence, in the distant south, and thus had to spend most of her time away from Paris, Madame de Sévigné was heartbroken. But it was to this circumstance that we owe the wonderful letters which she wrote to this spoiled petulant daughter, during 25 years. The letters are filled with many little chatty gossipy things, which tell us more than a solemn history ever could about the real life of those days. But what people like most about these letters is their deep affection, bright humor, sincerity, and freshness. For Madame de Sévigné seems to have taken her own delightful, observant, laughing, living self, and put it upon paper for all time.

SEVILLE (*sē-vĭl′*), SPAIN. It is said that there is never a day when the sun does not shine in Seville, "the pearl of Andalusia," the most Spanish of cities, whose palms and gardens are always green along the brown course of the Guadalquivir. Roses bloom the year round, and olive trees, oranges, and vines flourish.

But Seville is at the height of its glory in April, when the orange trees burst into bloom almost overnight and fill the city with fragrance. "The air is very soft, as of April in Seville" was Columbus' expression of delight as he approached the West Indies in 1492; and it is still the ideal of every Spaniard who can to get to Seville for the great religious processions of Holy Week and the gay spring festival coming at the middle of April.

One of the oldest Spanish cities, Seville still has many traces of the days when it flourished under the Moors, 700 years and more ago. Though there are many fine broad modern boulevards, in the older quarters the streets are crooked and sometimes so narrow that a donkey's swinging baskets of fruits and vegetables touch the house walls on either side. The whitewashed houses have balconies that overhang the street, and through the open gateways one catches glimpses of *patios* or central courts after the oriental fashion, with fountains and orange trees and trellises of flowers. In such ancient streets, life goes gaily on as in the days of old, to the strumming of guitars and the clicking of castanets. Four of the best known operas have sought to catch the color and gayety of street life in Seville: Mozart's 'Marriage of Figaro' and 'Don Juan', Bizet's 'Carmen', and Rossini's 'Barber of Seville'.

Moorish too is the famous Alcazar, which in spite of much rebuilding remains an example of the Moorish fortress palace comparable only to the Alhambra at Granada—a place of gardens and lofty arabesqued halls and courts. Seville possesses magnificent architecture of the Christian type as well, notably its cathedral, which is one of the largest Gothic temples in existence—380 feet long by 250 wide, with the tower-like pillars of its dimly lighted nave soaring to a height of 132 feet. Begun in 1402, it was over a hundred years in building. From the earlier Moorish mosque it retains its beautiful court of oranges, and the Giralda, once a minaret, now a belfry. This delicately wrought tower is so strong that it has withstood earthquakes which all but ruined the mighty cathedral itself. In the cathedral, in the museum, the hospital, and elsewhere one is surrounded by works of the painter Murillo, who, like Velasquez, was born in Seville.

From its wharves among the trees, ocean vessels carry abroad Seville's wines, olives, oils, oranges, and ores. For Seville, although nearly 60 miles from the sea, is Spain's fourth largest city and has been an important seaport from the earliest times, since the Guadalquivir is a tidal stream even above Seville, and admits ships of considerable draught. For many years Seville had a monopoly of the American trade, thereby becoming the richest port of Spain. The city still preserves in its archives documents relating to the discovery and conquest of America; autographs of Pizarro, Cortez, Magellan, and Americus Vespucius; and a signed letter of Cervantes applying for a position in America. In a library founded in the early 16th century by a son of Columbus, Fernando Colon, there is an important manuscript record of Columbus' voyage; and the ashes of Columbus himself now rest in the cathedral, to which they were brought from Havana at the end of the Spanish-American War.

Seville was an important center in Roman times. Part of its water supply is still brought by a Roman aqueduct. It passed into the hands of the Vandals and of the Visigoths; and in 712 it was captured by the Moors, remaining a Moslem city until its recapture in 1248 by Ferdinand III of Castile. Since before Roman times, Triana, a suburb on the right bank of the Guadalquivir, has made pottery. Other important industries are the manufacture of tobacco, chocolate, soap, corks, iron, and silk. Seville has a famous university. Population, about 165,000.

SEWARD (*sū'ērd*), **WILLIAM HENRY** (1801–1872). In the spring of 1860 William Henry Seward, then the recognized leader of the Republicans, left his seat in the United States Senate and retired to his home at Auburn, N. Y., to await the expected news of his nomination for the presidency by the national Republican convention in session at Chicago. To his surprise and chagrin the nomination was given to Lincoln, an Illinois lawyer, whose name was scarcely known outside of his own state.

Seward's surprise was natural, for he had been a brilliant lawyer and a leading figure in New York and national politics for 30 years. He was graduated from Union college at the age of 19, and admitted to the bar two years later. He played politics as easily as he breathed, and he had a ready gift of flowery eloquence. Once, when Lincoln and Seward were on a trip together, and a crowd was calling for a speech, Lincoln turned to Seward, and said, "Seward, you go out and repeat some of your *poetry* to the people."

Seward had served as New York state senator (1830–34), as governor of that commonwealth (1839–43), and for 12 years as United States senator (1849–61). He had long been conspicuous as a foe of slavery, and in 1850 he had created a sensation by a speech in the Senate when he had declared: "The Constitution devotes the Domain (i.e., the territories) to liberty. But there is a *higher law* than the Constitution which devotes it to the same noble purpose." Like Lincoln he had later seen that there was an "irrepressible conflict" between the principles of slavery and freedom, and that the nation must become either all slave territory or all free.

He Accepts Lincoln's Leadership

In consideration of his experience and ability it is no wonder that Seward was deeply disappointed when Lincoln was the one who received the Republican nomination. Nevertheless he hid his chagrin and accepted the position of secretary of state in Lincoln's cabinet. At first he felt, as did most of the country, that he would be the power behind the throne and the president would be a mere figurehead. Soon after Lincoln took office Seward wrote to his wife, "If I am absent only three days, this administration, the Congress, and the District would fall into consternation and despair." In a short time, however, Lincoln had tactfully but unmistakably demonstrated that *he* was the head of the government. Seward's opinion of Lincoln's qualities became so changed that in a later letter to his wife he said: "Executive skill and vigor are rare qualities. The President is the best of us."

During the war Seward had a wide field in which to display his patriotic abilities, and he rendered invaluable service. In spite of the difficulties with England (*see* 'Alabama' Claims; Trent Affair) he managed relations with that country and with France so that neither recognized the independence of the Confederate States, although each had at times seemed inclined to do so.

So prominent a part did Seward play in the administration that on the night that an assassin's bullet struck down Lincoln, an attempt was made on Seward's life also. The wound did not prove fatal, and for four years more Seward carried the heavy burden of the office of the secretary of state, under President Johnson. His greatest achievement after the close of the war was the negotiation of the treaty by which the United States purchased Alaska from Russia, in 1867 (*see* Alaska).

SEWERAGE. Life insurance experts tell us that the span of life is growing longer. You can expect to live longer than your grandfather, just as the people of his generation lived longer on the average than those of the generation before. This is chiefly the result of our increased knowledge of the causes of disease and improvements in hygiene and sanitation. Among the various factors which help to make life safer and longer today, none perhaps is more important than the science of sanitary engineering, which so greatly reduces disease by safeguarding our water supply and removing poisonous wastes from our houses (*see* Plumbing; Waterworks).

Sewers are built of brick, cement, or stone masonry, and may be 20 feet or more in diameter. Sewage is carried through them generally by natural flow, or gravitation, although sometimes pumping stations are necessary to distribute it properly. The refuse should be mixed with plenty of water to insure a steady flow—at least 2½ feet a second—and in many places rain water and other surface drainage which must be carried away is conducted into the sewers through the catch basins in the gutters. This plan, however, is open to objections, because sometimes sewer gases escape as the storm water enters; and the more sanitary plan is to keep the pipes of the surface drainage system separate from those of the sewer system. In the latter system the flushing of the sewers is done from tanks supplied with water from the city waterworks.

The disposal of sewage, involving some of the most difficult of all engineering problems, has long engaged the attention of city health departments. In small communities each house disposes of its own sewage, usually in the soil, taking care not to contaminate wells or other water supply; but in crowded towns other means must be used.

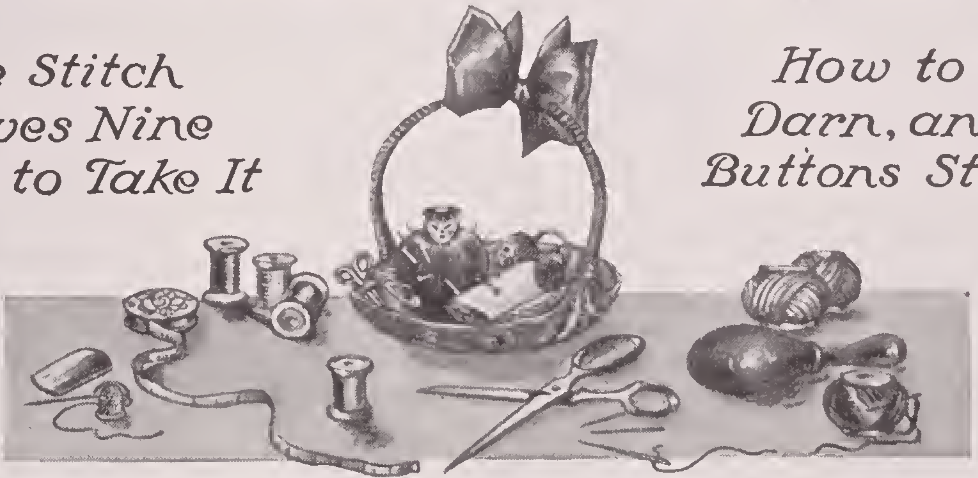
Sometimes sewage is conveyed out of town to deep water in seas, lakes, or rivers; but even in large bodies of water this often pollutes the drinking water supply, causing typhoid fever and other diseases. It was in order to avoid polluting its water supply from Lake Michigan that Chicago built her $50,000,000 drainage canal (*see* Canals). The more scientific methods of sewage disposal consist of chemical filtration and treatment, so as to kill all organic matter and make the solid matter, or sludge, available as a fertilizer; and the use of bacteria in *contact beds* and *septic tanks* to purify the sewage. Another method is by broad irrigation, or sewage farming—the utilization of sewage in growing crops. The sewage is run over a large area of land and left to oxidize in the air. The Chinese thus make use of material which otherwise would be wasted. The world's largest sewage farms are those of Paris and Berlin.

Such systems of sewage disposal as are in use today date only from about the middle of the 19th century. During the Middle Ages open drains running through the streets served as sewers. In later times the sewage was conducted to open cesspools on the outskirts of the city. The ancient Romans had sewerage systems far in advance of anything known in Europe until the 19th century, draining the city by three natural streams confined within stone tunnels. The largest of these, the *Cloaca Maxima*, parts of which date from the 3d century B.C., is still in use.

NEEDLE ARITHMETIC : ONE EQUALS NINE

The Little Stitch that Saves Nine and How to Take It

How to Patch, Darn, and Make Buttons Stay Put



SEWING. One of the first things a certain little girl remembers is how an aunt of hers, who was teaching her to sew, would look at her over her steel-rimmed spectacles and say, "You know, my dear, a stitch in time saves nine."

"Yes ma'am," she would answer politely, and then wonder and wonder, "Nine *what?*" It wasn't until she was quite a grown-up girl that she knew her aunt meant that one stitch sewed when a tear or hole was tiny would save sewing nine or maybe more stitches if she let the hole go unmended until it grew big.

Suppose we start in today to learn to mend and then, perhaps tomorrow, you can make something really new, right from the beginning.

Mending is the best thing to begin on in learning to sew, for many reasons. First, if the sewing doesn't come out just right you won't be spoiling new material. Second, if you learn to mend, you can mend while mother spends her time on making pretty new dresses for you. Third, each piece of mending doesn't take you as long as it would to make a new garment, and you won't get tired and discouraged about it.

Fourth, you can learn all the sewing stitches in mending. And the last reason is, that if you always keep your clothes well mended you will look much better dressed than girls who have more clothes, but who are careless about loose hooks and eyes and missing buttons and don't mend little tears and rips.

Now get everything ready on a broad window sill or little table where you can have good light and a comfortable chair. Here are the things you will need if you are going to do all kinds of mending.

1. A pair of small sharp scissors.
2. One large, one small, and one darning needle.
3. Darning cotton in the colors of the stockings.
4. A darning egg or hard ball of some sort.
5. Number 40 white and black cotton thread for sewing on buttons.
6. Old muslin for patching.
7. Number 60 white and black thread for sewing on ripped lace.
8. A tape measure.
9. A thimble.
10. A package of pins.

Put your thimble on the third finger of your right hand and push the needle with the top or side of it, and you won't have a sore finger when you are through sewing. You had better leave silk stockings for mother to do until you learn to darn cotton stockings extra well.

Each little girl who takes this sewing lesson will have different kinds of mending to do; so we are going to try to write a sort of handbook of mending, so you can find directions for just the kind you need when you start to mend.

Basting.—Basting is like so many games you play that it ought to be easy for you. It is used to hold two edges of cloth together, or to hold a patch on until you do the finer stitches that will stay in and make the mending strong. Then you pull the basting thread out. Pretend that you are playing jump from one stone or one step to another one. Then you will see how basting should look. Each step or stone is a small stitch and the space you jump is the long stitch in between. As in this picture (Fig. 1), put your needle *down* through the cloth at number 1, then *up* through the cloth at number 2. This will bring the needle through to the right side. Then jump your needle to number 3 and put it down at 3 to the wrong side, and up through 4 to the right side. Now jump to 5 and do the same way with each stitch. Hold the two pieces of cloth firmly together so they won't slip, and be sure at each stitch that your needle goes clear through both pieces of cloth.

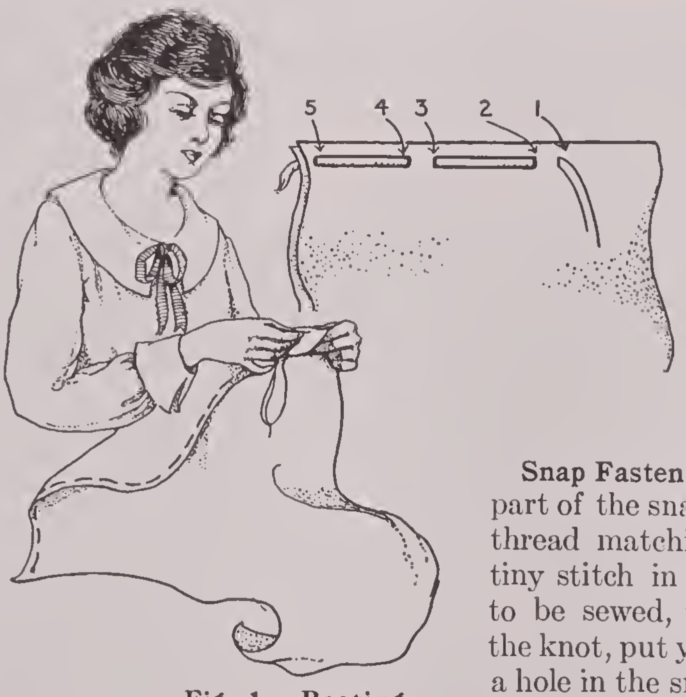


Fig. 1. Basting

Buttons.—First find the button which came off the garment or one that nearly matches it in size, color, and material. Of course for a coat or dress you must have one just like the rest. Sometimes when a button of this kind is lost you can take one from another part of the coat or dress where it won't show.

Thread your large needle with No. 40 thread of the right color. Pull the ends of the thread together, so that the thread is double, and tie a knot. Mother can show you about the knot better than it can be explained here by pictures or writing. Mark, with a pin, the place where the button is to go. Start the needle by pushing it from the right to the wrong side. Then the knot will be on the right side and under the button. Bring the needle through to the right side and put it through a hole in the button. Put a pin across the top of the button and hold it with your left hand until you have taken enough stitches to hold it in place (Fig. 2.)

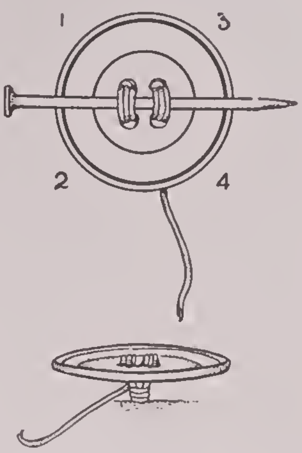


Fig. 2. Sewing on Buttons

The needle should go up through the hole number 1 and down through 2, up through 1 and down through 2 for a button with two holes. For a button with four holes, up at 1, down at 2, up at 3, and down at 4, then up at 1 again, and over and over the same way until the button is sewed tight. Now pull out the pin and pull the button gently until the threads are tight. Push the needle from the wrong side and bring it out *between* the cloth and the button. Hold the button in your left hand and wind the thread tightly around the stitches three or four times. Push the needle to the wrong side and fasten the thread. The pin is used to make the stitches long enough to make the little neck, and the thread is wound around the stitches to make them strong. This neck of thread gives room for the buttonhole to go under the button.

Snap Fasteners.—Mark the place for each part of the snap with a pin. With a strong thread matching the snap in color take a tiny stitch in the cloth where the snap is to be sewed, then, holding the snap over the knot, put your needle in the cloth beside a hole in the snap and take a stitch to bring your needle up through it. Repeat several times, then slide your needle under the snap to the next hole. When all the holes have been sewed through, fasten and cut your thread.

Buttonholes.—Sometimes the buttons have pulled until they have torn through the buttonholing, and then it must be fixed or there will be a bad tear through the edge of the garment. First, catch the torn place together until it is as nearly the size of the old buttonhole as possible, and fasten securely. Then buttonhole over the mended place. To make buttonholes with a nice cord along the edge, bring the needle through and throw the thread over the needle toward your left hand (Fig. 3). When you come to the outer edge of the buttonhole make three or five stitches around it throwing the thread the other way. This is called "blanket-stitching"; it makes a very strong edge, but it does not make a cord as along the sides.

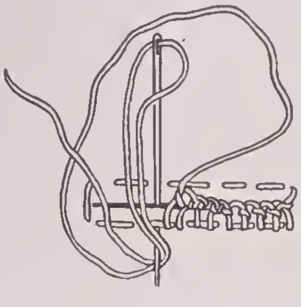


Fig. 3 Making a Buttonhole

Hooks and Eyes.—Always use very strong thread for sewing on hooks and eyes. Mark with pins the place where they are to be sewed so you will be sure to have them exactly opposite each other. Put the loop of the eye a little beyond the folded edge of the cloth. For the straight kind of eye put it about a quarter of an inch in from the edge. Hold the eye in place with your left hand. Sew closely over and over the two circles of the eye, until they are covered with thread; then take three or four stitches over each other at the bottom of the loop on each side. Be sure to fasten your thread well. Lap your two pieces of cloth, and put the hook into the eye which you have sewed on. Hold the hook in place with your left hand and take it out of the eye. Sew over and over the two circles, as you did with the eye, then sew in the same way the under part of the hook clear up to the bend.

Darning.—Darning is done the same way you used to weave paper mats at kindergarten or in the first grade. Be sure to use only two or three threads of the darning cotton. It is usually made of six threads, so you will have to divide it. A heavy thread makes a hard lump and hurts your feet. Pull your darning thread just smooth, but not tight enough to pucker the edges of the hole, for this makes a lump.

Place your darning egg under the hole, but do not pull the stocking tight, only smooth, or you will stretch the hole larger. Thread your needle, but make no knot in the thread. Start at the top of the hole (the edge nearest the top of the stocking) about one-half inch from the edge of the hole (Fig. 4). Take some small running stitches to the edge of the hole, bring the needle to the other side of the hole, and take running stitches here for half an inch. Do another row about one-eighth of an inch from the first one and keep on until you have up and down threads clear across the hole. This looks now like the paper mats before you begin to weave. Start to sew in small running stitches across the first ones until you reach the hole. Go over and under, under and over, these straight threads, exactly as though you were weaving paper mats. Make your rows close enough together so they leave no empty spaces, and fill up the holes. You must always take the running stitches beyond the edge of the hole or the darn will be apt to tear away, as the cloth near the hole is usually thin and not strong. A really good darn should be almost as smooth as the stocking. If it is not, you are using too heavy a thread or pulling it too tight.

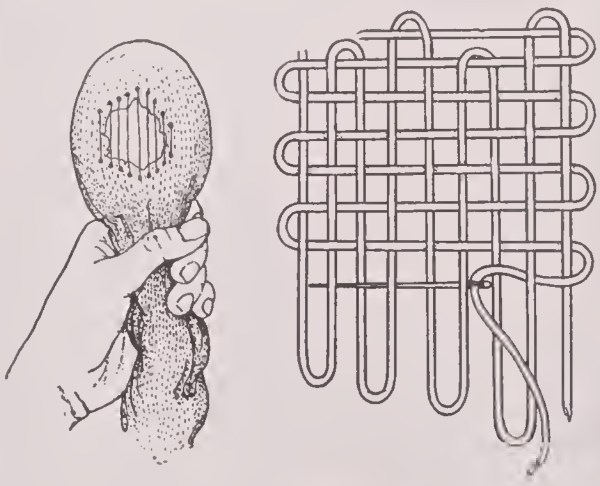


Fig. 4 Darning

Gathering.—Gathering is needed in mending when an apron or skirt has torn from the band. A double thread is best as it is strongest. Fold the goods to mark where you wish to sew, or sew along the old line of sewing. Use a stitch like the basting stitch but make the space between the stitches shorter than in basting. Put a pin at the left hand or finishing end of the gathers. When your gathering thread is in, pull it until the goods is the same length as the piece to which it is to be sewed. Wind the thread around the pin to hold the gathers tight. Push gathers evenly so that they are not in a bunch. Then hold the edge of the skirt and the edge of the inner side of the belt together so that the raw edges will be on the outside, and sew together with a small running stitch. Smooth the upper piece of the belt down over the seam you have just made, fold in the edge a quarter of an inch, and sew to the skirt with a small hemming stitch.

To fasten the thread at the end of the seam, make three or four stitches in the same holes. In fastening basting you keep sewing the last small stitch, going down and up three or four times over the stitch and then cutting your thread.

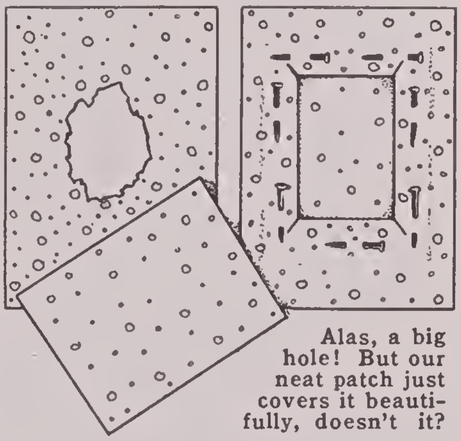
Hemming.—Be sure that the edge of the cloth to be hemmed is straight. Make a folded edge about one quarter of an inch wide. Crease it hard with your thumbnail. Then fold over again, this time as wide as you want the finished hem to be. If you are making a hem more than half an inch wide, you had better measure every few inches, as you fold, with a piece of stiff cardboard. When you have folded the hem, baste it in place. Tie a knot in your thread; then holding the fold toward you and the loose edge hanging down, put the needle through the fold, at the right-hand end, and slip the knot underneath, so it is hidden. Now take two or three threads of the cloth and two or three threads of the fold and pull the needle through. Have your needle pointing in a slanting stitch toward your left shoulder. When you need a new thread, fasten the old one with tiny stitches and hide the knot of the new one under the fold.

Overcasting and Overhanding.—Overcasting and overhanding are almost the same, except that overhanding is done closer together. They are both very easy and with a little practice you can make the stitches even in depth and in distance apart. Overcasting is done to keep the edge of material from raveling. Overhanding is used in sewing on lace or joining two selvages or folds together.

It is best to baste the two pieces of material together if you are not an expert at sewing. Put the needle between the two layers of goods for the first stitch so that the knot will be hidden.

For overcasting make the stitches one-eighth of an inch deep and about a quarter of an inch apart, and hold the needle slanting toward your left shoulder. For overhanding take up only a few threads of the cloth. Make the stitches close together and point the needle straight toward you.

Patching.—Sometimes you will have a hole to mend that is too big to darn and you will have to patch it. First cut all the rough edges and loose threads away. Cut a piece of cloth to match the garment, at least twice as big as the hole. Pin it under the hole so that the pattern, if there is one, matches perfectly. Turn under the edges of the cloth on the right side and baste down. Put the patch on the wrong side, so that it is just big enough to cover all the thin part which is usually around a hole. Fold under the edges of the patch and baste. Now hem, with small stitches, the basted edges on both sides of the goods. Pull out the basting threads and press the patch. If you want a very nice patch, cut the hole square before you start to patch it. Then make a cut about a quarter of an inch deep at each corner so that the edges will turn under nicely.



Alas, a big hole! But our neat patch just covers it beautifully, doesn't it?

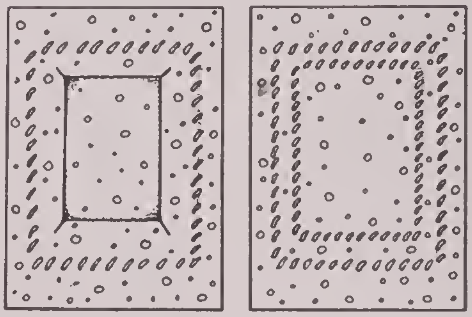
Running.—The running stitch is much like basting, except that the stitches and the distance between the stitches are of even length. It is used for quick hemming and for gathering. Start at the right-hand end of the cloth and make the needle go under and over, under and over, the threads in the cloth, taking *up* as many threads as you go *over*. Only please don't try to count the threads, as this would strain your eyes. Just make the stitches as even as you can.

Seams.—The running stitch you have just learned will be very useful to you if you have a ripped seam in your dress. If the seam is an open seam, hold the two edges together on the wrong side of your dress and sew with a short running stitch until the ripped place has been completely closed. Then open out your seam and press flat. If the seam is a French seam, sew up the ripped place with a running stitch so that the raw edges are on the right side of your dress. Open the material, turn the sides over the seam, and again sew up the ripped place with a running stitch so that the first seam is inside the second one. Then no raw edges will show. This makes what is called a French seam.

Making a Bean Bag.—And now the lesson part is over and we can have some fun. Let's make bean bags! Then get brother to cut a few holes in a board, paint a number—5, 10, 15, 20—one below each hole, and get ready for a game of "chuck-a-luck."

We will make bean bags while the board is being made. For each bag cut a piece of cloth four and one half by nine inches. Fold this so it makes a square, and baste two of the sides to hold them firm. The fold makes the third side, and the fourth side we must leave open to put in the beans.

Sew the two basted sides with a small running stitch and then *overcast* the rough edges. Turn the bags right side out. Fold down the open edge a quarter of an inch deep all around so that the fold is on the inside. *Overhand* the two folded edges together for about half the length of the side. Fill the bag half full of beans or peas or small pebbles, and finish sewing up the side. Use strong thread (about No. 40) and fasten it well. These bean bags will be a real test of careful sewing, because they must be well sewed and carefully fastened or they will surely pop open, and the beans will be lost and the game over before you have managed to throw them through the holes in the board.

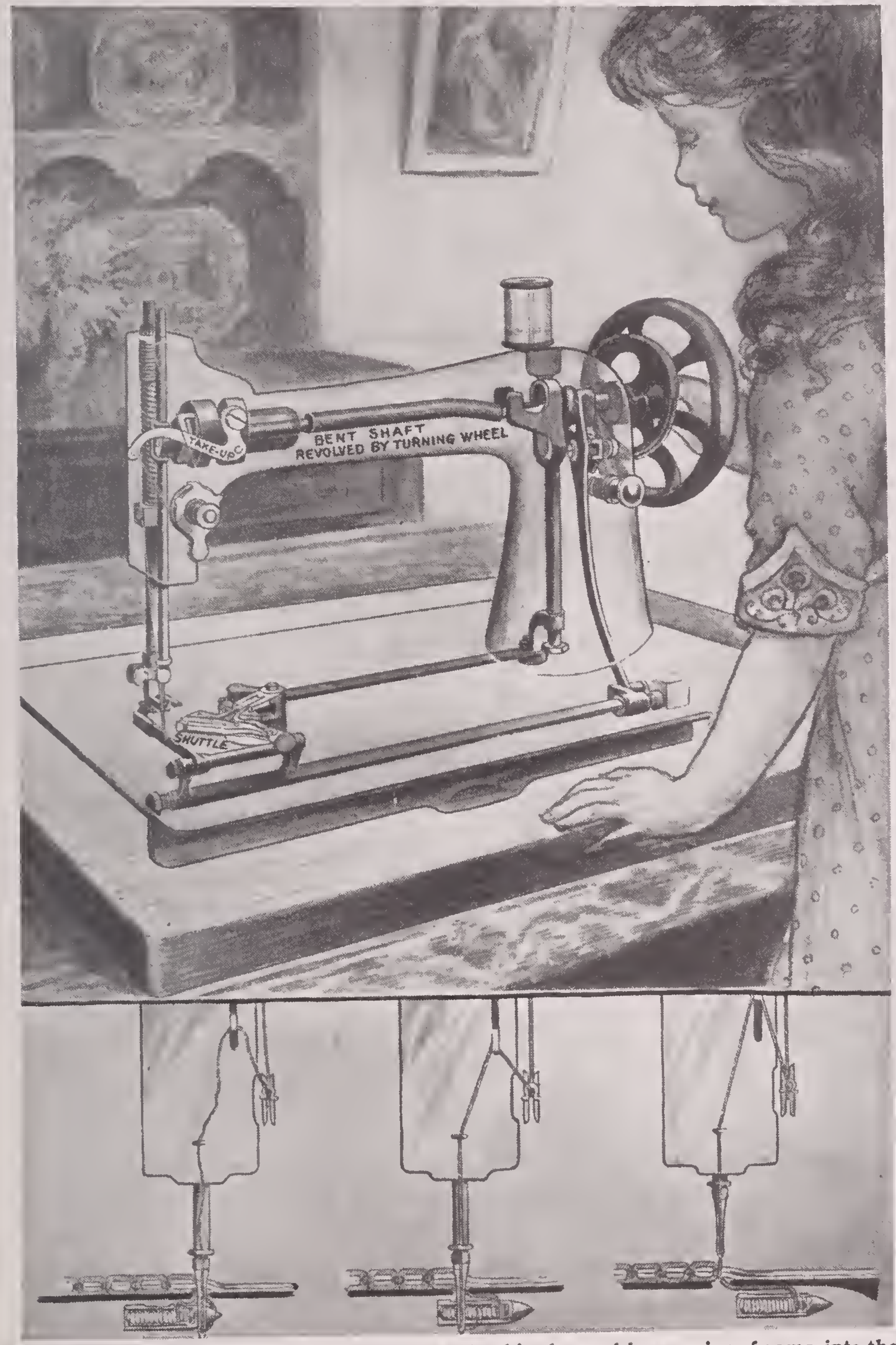


And now we must give you some advice on how to use mother's sewing machine. It is simply this: *Don't,* unless she has time to teach you how to use it the right way. But if you will first learn how to do hand sewing well, mother will no doubt be glad to have you learn to sew on the machine.

SEWING MACHINE. From the middle of the 18th century many inventors in England and the United States tried to make machines that would imitate the movements of the needlewoman's fingers. One of the vital defects in the earlier inventions was that the cloth had to be "fed" to the machine by hand. No substantial progress was made toward building a practicable sewing machine until about the middle of the 19th century.

By that time it was realized that it was not necessary for the whole needle to go through the cloth for each stitch; and the machine needle with an eye near the point, and the "lock stitch"—such as are in use today—had appeared. The lock stitch makes use of two threads. The first thread, passing through the eye of the needle, is pushed down with the needle through the cloth, and forms a loop below. The other thread, underneath the cloth, is carried through the loop by a shuttle, thus "locking" the stitch.

HOW THE SEWING MACHINE WORKS


TAKE-UP
BENT SHAFT REVOLVED BY TURNING WHEEL
SHUTTLE

The motion of the bent shaft turned by the wheel is changed by a series of cams into the up-and-down motion of the needle and the to-and-fro motion of the shuttle. The "take-up" makes the thread fed to the needle alternately tight and loose, as needed. The three pictures below show how the upper thread catches up the lower to make a stitch, the shuttle passing through the loop in the upper thread each time the needle comes down.

Such a needle was combined with the lock stitch in a machine patented about 1846 by Elias Howe of Massachusetts. This, the first really practicable sewing machine, was further equipped with a mechanical device for feeding the cloth, but the needle moved back and forth horizontally instead of vertically, as in our modern machines. Howe and his machine were denounced by garment workers and tailors, who feared it would deprive them of their means of livelihood. But gradually his machine came into use; and for about 25 years—the courts having sustained him in 1854 in a long legal fight over patent rights — Howe collected royalties on every machine made, and thus was lifted from poverty to a fortune of more than $2,000,000 (*see* Howe, Elias).

About the same time John Bachelder devised the first machine combining the horizontal table with a continuous feeding device that would sew any length of seam. He used a leather belt set with small steel points to carry the material along. But the greatest improvement of all was made by Allen B. Winslow, a Michigan cabinet maker, who in 1854 patented his celebrated "four motion feed," employed in practically all machines today. This device consists of a toothed metal plate which moves forward, carrying the cloth with it, then drops out of contact with the cloth, moves back, and rises to carry the cloth forward again.

Meanwhile, Isaac M. Singer had invented the first "rigid arm" sewing machine, and had made important improvements in the shuttle. He finally obtained a patent after a long law suit with Howe. James Gibbs invented a "chain stitch" machine, later improved by J. Willcox, also an American. In this machine the loop of each stitch passes through and, by means of a hook, secures the loop of the previous stitch, something like the stitch in crocheting.

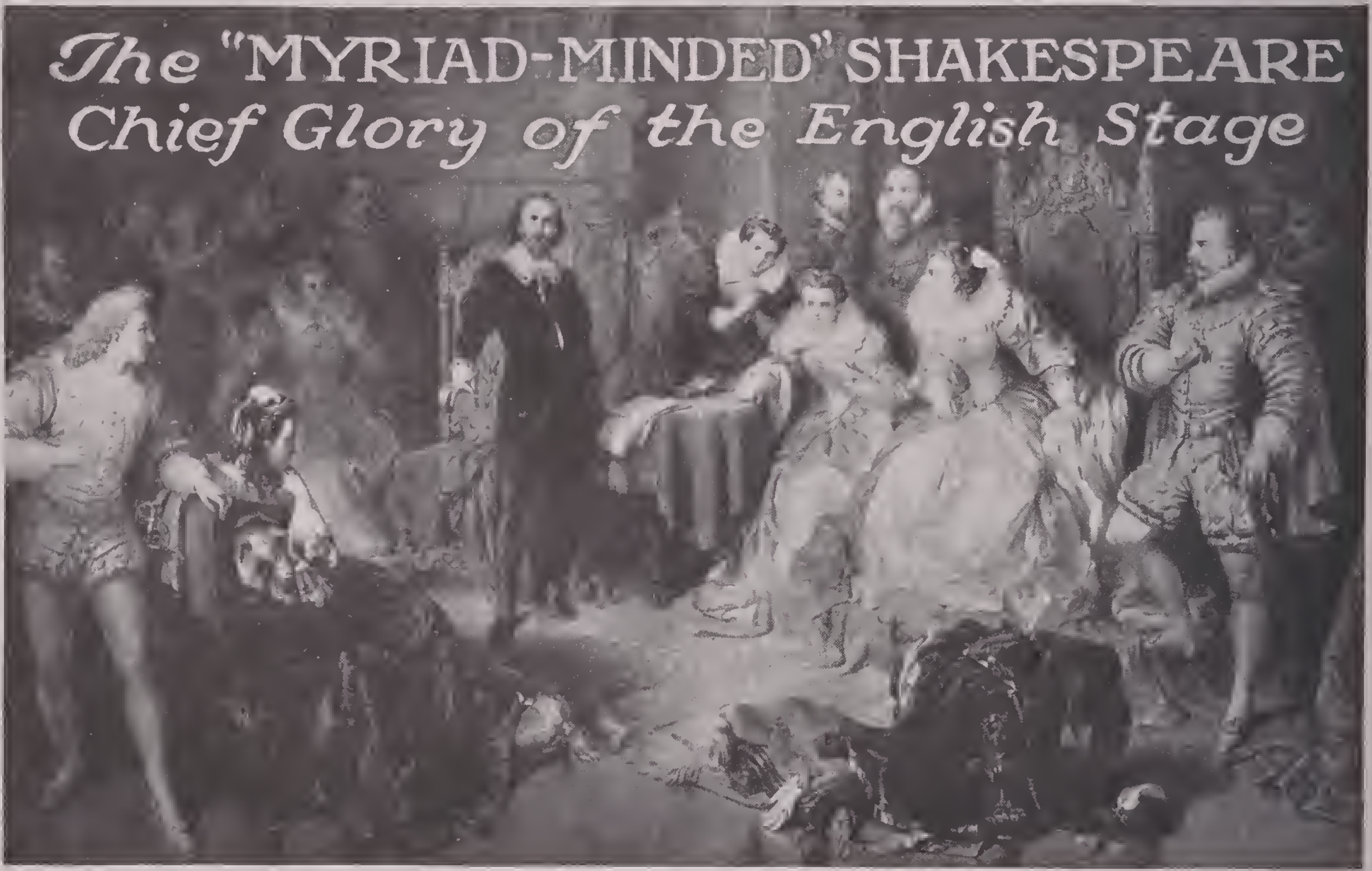
These early machines have been developed to such an amazing extent, both for home and factory uses, that today there are machines for sewing almost every article of clothing, upholstery, embroidery, canvas, leather goods, etc., some of which run as fast as 4,000 stitches a minute. More than 600 kinds of machines are made by one company. There are machines for making buttonholes, and others for sewing on buttons. There are machines for faggoting, feather-stitching, pattern-stitching, hemstitching, smocking, ruffling, tucking, side and box plaiting, basting, and quilting. There are single and double needle machines, and those with four, six, and eight needles for glove work. Of these special machines the most important is the shoe-sewing machine (*see* Shoes). Meanwhile the household type has been improved and modified, chiefly in order to carry special attachments, until now the same machine can handle a great variety of work.

The United States leads the world in the manufacture of sewing machines and its output goes to the remotest parts of the globe.

Shad. This highly esteemed food fish belongs to the herring family, but is larger than the ordinary herring—averaging three to six pounds—and differs from it in the absence of teeth in the jaws and in the form of the cheek, which is deeper than long. The numerous slender pinlike bones which prove so annoying when one is eating shad are chiefly several series of bones which support the muscle segments above the ribs.

The shad fisheries in Delaware Bay and River, Chesapeake Bay, and North Carolina sounds are very extensive. In the bays and estuaries the fish are taken in pound nets and weirs, but in the rivers gill nets and seines are used, some of which are more than a mile in length and are hauled in by means of donkey engines. There are several species of shad, all of the genus *Clupea*.

The "MYRIAD-MINDED" SHAKESPEARE Chief Glory of the English Stage



Shakespeare Reading 'Macbeth' before Queen Elizabeth, from a Picture by Eduard Ender

SHAKESPEARE, William (1564–1616). Only in the "spacious days" of Queen Elizabeth could Shakespeare's genius have been fostered and developed to the full. The religious strife of the Reformation was at a lull, and by the defeat of the Armada the nation had escaped the danger of Spanish conquest. The dawning New World was opening to English colonization through the labors of Cabot, Drake, and Raleigh. New lands, new ideas, new books, the new learning of the Renaissance, had set the imaginations of men on fire. Altogether, Englishmen found the world with its new horizon a place well worth living in. Men were anxious to learn all there was to learn and to feel all there was to feel, and no other form of art could bring the world to England's door more readily than the drama. Such an age demanded a genius to hold up the mirror to all its rich and varied life, and found him in William Shakespeare.

It is strange that although the people of his time loved and honored Shakespeare as "Soule of the Age" (as his friend Ben Jonson put it), there is a very scanty amount of actual fact left to us on which to base an account of his life. Scholars have gone to

SHAKESPEARE'S BIRTHPLACE, FROM THE GARDEN

The garden at the rear of the old Stratford house (at the right) in which Shakespeare was born is now made fragrant with the flowers and shady with the trees named in his works. The stone in the middle of the broad path is the base of the old 14th century "market cross" which once stood in the Stratford market square.

great pains to unearth obscure documents which touch his life, and to trace the development of his mind and character from his plays and poems; but we still know so little about the external events of his life that some have even questioned whether he was the author of the works that bear his name.

William Shakespeare was born at Stratford on the Avon near the end of April 1564. The exact day is uncertain. His parents came of good country stock that had lived in Warwickshire for generations. His father dealt in agricultural products and was at one time a glover and at another a butcher. The poet's mother, in spite of the fact that she came from a prosperous family, had no education; for women in those days were rarely educated.

William was their third child. He was fortunate in living in Stratford, because the town had the unusual advantage of a free endowed grammar school which all the sons of "freemen"—members of the governing body of the town—were entitled to attend. It is there that Shakespeare learned the "small Latine and lesse Greeke" of which his friend Ben Jonson writes. The French and Italian, with which he must have had some acquaintance, he probably acquired in London.

A genius, however, owes the least of his knowledge to schools. Shakespeare had the type of mind that sees a thing once and remembers it always, reads a thing once and makes it his own. And there were many advantages for him in his little town. Wandering companies of players turned his thoughts early to the stage. The historic pageant given at Kenilworth Castle for Queen Elizabeth by the Earl of Leicester must have aroused the boy's imagination, even if he did not see it himself. Then, too, Warwickshire, in which Stratford lies, is one of the most beautiful parts of England and, wandering through its woods and over its low hills, Shakespeare had ample chance to learn birds, flowers, and streams in all their "various language." His plays show that he loved nature and that he knew the country folklore. Books were few, but he had the Bible in English which could not help affecting his thinking and his style. Shakespeare's work shows plainly that he went through life with open mind, and what did not come to him directly his imagination could supply.

No one has as yet entirely accounted for his leaving Stratford about 1586. Some say that the unhappiness of his married life led to his departure; for at 18 he had married Anne Hathaway, a young woman eight years older than himself. Others say that his father's failure in business laid heavier burdens on the son. Still others cling to the tradition that Shakespeare had got into difficulties by putting mocking verses on Sir Thomas Lucy's gate—a nobleman who, as the story runs, had prosecuted him for deer-poaching in his park. No one knows the real reason for Shakespeare's departure, but it is a generally accepted fact that in his 21st year the young man left Stratford and walked to London by way of Oxford.

Almost nothing is known of his first years in London. It is not until six years later that we find any reference to his life there. In that year Robert Greene, a playwright who was then on his death-bed, published an attack warning his friends to beware of Shakespeare and of others of his kind. "Trust them not," he says, "for there is an upstart crow beautified with our feathers that with his Tyger's heart wrapped in a player's hide supposes he is well able to bumbast out a blank verse as the best of you; and being an absolute *Johannes Factotum* ("Jack of all trades") is in his own conceit the onely Shakescene in a countrie, but it is a pity men of such rare wit should be subject to the pleasures of such rude grooms." Soon after, a friend of Greene's printed an apology for the attack, saying that Shakespeare was "excellent in the quality he professes." By his 28th year, then, it is plain that he was prominent enough in the theater to have aroused both the envy and the admiration of his associates.

After all, there is a grain of truth in Greene's epithet "Jack of all Trades." On his arrival in London it is believed that he earned his living as call boy or page in a theater, but was soon promoted to small parts on the stage. His name came to be associated on playbills with that of Burbage, Kempe, and Condell, who were the best actors of the day. But Shakespeare never played leading characters. It was in such parts as that of the ghost in 'Hamlet' and of Adam, the old man in 'As you like It', that he appeared at the Old Globe Theater perhaps sometimes before Queen Elizabeth herself.

Shakespeare Finds His Field

Shakespeare soon learned that his bent was not for acting but playwriting—adapting old plays, imitating others, and writing dramas of his own for production in the theaters to whose companies he belonged. He took the blank verse which Greene and Marlowe had used before him and made it the most varied and flexible of English rhythms. He learned how to carry over the meaning from line to line; how to vary the pauses so that what had been a rather monotonous form now became a delicate instrument on which he could play as he wished. His power grew through the years. Each play shows greater freedom than the one which preceded it—not only in verse music but in construction and in the depth and power of the emotion expressed.

The chief plays are treated separately in these volumes under their titles. Here we shall only outline Shakespeare's development as a dramatist. He wrote about two plays a year and with such apparent ease that the players in his company boasted that he never blotted a line. Roughly speaking, there are four periods in his career, which covered about 20 years—from 1591 to 1611. A well-known Shakespearian critic very aptly names these periods: "In the Workshop," "In the World," "Out of the Depths," and "On the Heights."

WHERE THE POET LEARNED HIS LESSONS

In this delightful old room, with its timbered roof, Shakespeare doubtless learned his "small Latine and lesse Greeke"; for this is the old Grammar School, in which Stratford boys have been taught from generations before Shakespeare's time to the present.

In the beginning he experimented, for the plays of the early period are of all kinds. He imitated the brutality of Marlowe in 'Titus Andronicus'. In 'Love's Labour Lost' he balanced phrase against phrase after the fashion of Lyly. He dramatized a romance in 'Two Gentlemen of Verona', and probably adapted and transformed many other plays which have been lost. 'Romeo and Juliet', probably written in 1597, is the first play which shows promise of his full powers. The plot was not his own, nor all the characters, but he put into it so much ardor and beauty that what he borrowed he made his own.

The plays of the second period consist largely of histories and comedies. England was eager to see her glorious and eventful story on the stage, so Shakespeare constructed a series of plays from Holinshed's 'Chronicles of England, Scotland, and Ireland' (1578). 'Henry IV' in its two parts is the best of these. All that he wrote at this time was marked by a light-hearted flow of spirits and tingles with the joy of living. To this period belong Falstaff, his greatest comedy figure, and the whole-souled women who delight us with their wit and laughter. Portia, Beatrice, and Viola are among his loveliest characters.

About 1600 Shakespeare seems to have passed into a mood of solemn questioning of life and death. His plays are no longer light-hearted, but become somber in tone and deeply philosophic. 'Hamlet' and 'Macbeth' require many readings and much thought to understand them, but they are the plays that we should be most loath to lose. 'King Lear' calls on all the elements of air and sky as a fit setting for the disappointed passion of the old mad king. In 'Othello' the passion of jealousy inspires a tragedy strong in form and masterly in dialogue and description. Terrible as these plays are in theme and plot, they are so permeated by Shakespeare's deep understanding of human nature and real power as a poet that they stand supreme among his works.

The last period of Shakespeare's career began after 1608. In it are found the plays which combine the wisdom of the Hamlet epoch with a more genial outlook on life. 'The Tempest', 'Cymbeline', and 'The Winter's Tale' show the serenity which so often color the more mature years of a great man's life.

Shakespeare's activities as an actor, as part owner of several theatres, as a playwright and poet made him a moderately rich man. He returned to Stratford to live and bought New Place, which is just around the corner from his birthplace. He probably divided his last six years between Stratford and London. He died in 1616, only 52 years old.

It is unfortunate for us that Shakespeare did not oversee the printing of his plays, but in his day such was not the custom. It was thought that it was to the interest of the theater to keep plays in manuscript, so that people must come to the playhouse if they wished to become acquainted with a writer's dramas. The result was that texts of only 16 of Shakespeare's plays were printed before 1623. Some of the 16 were duly registered according to law (copyrighted), and then printed, while others were taken down in shorthand in the theater and printed without permission. The latter copies were very faulty. Various editions of the plays were printed after Shakespeare's death, but it was not until 1623 that a complete edition (the first "folio" edition) was put forth, based in part on 20 hitherto unpublished plays furnished by John Hemings and Henry Condell, actors of Shakespeare's company. The edition was a success and another one was printed nine years later. Since that time hundreds of scholars have spent years in trying to make the copies of the plays as accurate as possible. New editions came out from time to time in English and in translations into all modern languages—for Shakespeare's works are as well known in Germany, France, and Russia as are those of their own great writers.

THE OLD GLOBE THEATER

In this dingy uncomfortable little theater in Southwark (long since destroyed) many of Shakespeare's plays, as well as those of Beaumont and Fletcher, Ben Jonson, and Ford, were produced. Shakespeare was a shareholder in it and drew from it some of the income on which his later prosperity was based.

Besides his plays, Shakespeare composed over 150 sonnets — short rhymed poems of 14 lines each—which remain among the noblest lyrics in the language. He wrote also several longer non-dramatic poems which he dedicated to the Earl of Southampton, his friend and patron.

What is it that makes Shakespeare endure as the supreme dramatist of the world, in spite of his many obvious faults? We may answer that he combines all the qualities that make literature enduring. He combines wisdom to understand and charity to forgive human frailties. He has the power to make humanity real, with feet fast on the ground no matter how high its head may tower toward the clouds. Gaiety, light-heartedness, laughter, pity, tears, passion, are all his. His work has the ease and careless grace of all masterpieces—and above all it is charming to the ear. As Ben Jonson truly said, "He was not of an age, but for all time."

Although there is considerable difference of opinion as to the dates of some of Shakespeare's works, most critics agree in general to this classification:

Period of Early Experiment — ("In the Workshop") (1591-1595). 'Love's Labour Lost'; 'Two Gentlemen of Verona'; 'Comedy of Errors'; 'Henry VI' (three parts); 'Richard III'; 'Richard II'; 'Titus Andronicus'; 'King John'; and the poems 'Venus and Adonis' and 'The Rape of Lucrece'.

Period of Development — ("In the World") (1595-1600). 'Romeo and Juliet'; 'Midsummer Night's Dream'; 'Merchant of Venice'; 'Taming of the Shrew'; 'Henry IV' (two parts); 'Merry Wives of Windsor'; 'Henry V'; 'Julius Caesar'; 'Much Ado about Nothing'; 'As You Like It'; 'Twelfth Night'.

Period of Maturity and Gloom — ("Out of the Depths") (1600-1608). 'Sonnets'; 'Hamlet'; 'Troilus and Cressida'; 'Othello'; 'All's Well that Ends Well'; 'Measure for Measure'; 'Macbeth'; 'King Lear'; 'Antony and Cleopatra'; 'Timon of Athens'.

Period of Serenity — ("On the Heights") (1608-1611). 'Pericles'; 'Coriolanus'; 'Cymbeline'; 'The Winter's Tale'; 'The Tempest'; 'Henry VIII'.

THE BEAUTIES OF NATURE

Night's candles are burned out, and jocund day
Stands tiptoe on the misty mountain tops.
—*Romeo and Juliet, Act III, Scene* v.

But, look, the morn, in russet mantle clad,
Walks o'er the dew of yon high eastern hill.
—*Hamlet, Act I, Scene* i.

How sweet the moonlight sleeps upon this bank!
Here will we sit and let the sounds of music
Creep in our ears. Soft stillness and the night
Become the touches of sweet harmony.
Sit, Jessica. Look how the floor of heaven
Is thick inlaid with patines of bright gold.
There's not the smallest orb which thou behold'st
But in his motion like an angel sings,
Still quiring to the young-ey'd cherubims;
Such harmony is in immortal souls;
But whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it.
—*The Merchant of Venice, Act V, Scene* i.

THE POWER OF MUSIC

The man that hath no music in himself,
Nor is not moved with concord of sweet sounds,
Is fit for treasons, stratagems, and spoils.
The motions of his spirit are dull as night
And his affections dark as Erebus.
Let no such man be trusted.
—*The Merchant of Venice, Act V, Scene* i.

If music be the food of love, play on!
Give me excess of it, that, surfeiting,
The appetite may sicken, and so die.
That strain again! It had a dying fall.
O, it came o'er my ear like the sweet sound
That breathes upon a bank of violets,
Stealing and giving odour.
—*Twelfth Night, Act I, Scene* i.

VIEWS OF LIFE AND DEATH

Our revels now are ended. These our actors,
As I foretold you, were all spirits, and
Are melted into air, into thin air;
And, like the baseless fabric of this vision,
The cloud-capp'd towers, the gorgeous palaces,
The solemn temples, the great globe itself,
Yea, all which it inherit, shall dissolve
And, like this insubstantial pageant faded,
Leave not a rack behind. We are such stuff
As dreams are made on, and our little life
Is rounded with a sleep.
—*The Tempest, Act IV, Scene* i.

Cowards die many times before their deaths;
The valiant never taste of death but once.
Of all the wonders that I yet have heard,
It seems to me most strange that men should fear;
Seeing that death, a necessary end,
Will come when it will come.
—*Julius Caesar, Act II, Scene* ii.

To-morrow, and to-morrow, and to-morrow,
Creeps in this petty pace from day to day
To the last syllable of recorded time;
And all our yesterdays have lighted fools
The way to dusty death. Out, out, brief candle!
Life's but a walking shadow, a poor player
That struts and frets his hour upon the stage
And then is heard no more. It is a tale
Told by an idiot, full of sound and fury,
Signifying nothing.
—*Macbeth, Act V, Scene* v.

O, that this too too solid flesh would melt,
Thaw, and resolve itself into a dew!
Or that the Everlasting had not fixed
His canon 'gainst self-slaughter! O God! God!
How weary, stale, flat, and unprofitable,
Seems to me all the uses of this world!
Fie on't! ah fie! 'Tis an unweeded garden,
That grows to seed; things rank and gross in nature
Possess it merely.
—*Hamlet, Act I, Scene* ii.

THE LESSONS OF PHILOSOPHY

Sweet are the uses of adversity,
Which, like the toad, ugly and venomous,
Wears yet a precious jewel in his head;
And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in every thing.
—*As You Like It, Act II, Scene* i.

The fool doth think he is wise, but the wise man knows himself to be a fool.
—*As You Like It, Act V, Scene* i.

Some are born great, some achieve greatness, and some have greatness thrust upon 'em.
—*Twelfth Night, Act II, Scene* v.

THE SEVEN STAGES OF LIFE

All the world's a stage,
And all the men and women merely players.
They have their exits and their entrances,
And one man in his time plays many parts,
His acts being seven ages. At first the infant,
Mewling and puking in the nurse's arms.
And then the whining school-boy, with his satchel
And shining morning face, creeping like snail
Unwillingly to school. And then the lover,
Sighing like furnace, with a woeful ballad
Made to his mistress' eyebrow. Then a soldier,
Full of strange oaths, and bearded like the pard,
Jealous in honour, sudden and quick in quarrel,
Seeking the bubble reputation
Even in the cannon's mouth. And then the justice,
In fair round belly with good capon lin'd,
With eyes severe and beard of formal cut,
Full of wise saws and modern instances;
And so he plays his part. The sixth age shifts
Into the lean and slipper'd pantaloon,
With spectacles on nose and pouch on side,
His youthful hose, well sav'd, a world too wide
For his shrunk shank; and his big manly voice,
Turning again toward childish treble, pipes
And whistles in his sound. Last scene of all,
That ends this strange eventful history,
Is second childishness and mere oblivion,
Sans teeth, sans eyes, sans taste, sans everything.
—*As You Like It, Act II, Scene* vii.

KING LEAR WITH CORDELIA DEAD IN HIS ARMS

LEAR. *Howl, howl, howl, howl! O*
you are men of stones;
Had I your tongues and eyes, I'd use
them so
That heaven's vault should crack.
She's gone for ever!
I know when one is dead, and when
one lives;
She's dead as earth. . . .

This feather stirs; she lives! if it
be so,
It is a chance which does redeem all
sorrows
That ever I have felt. . . .

A plague upon you, murderers, traitors all!
I might have saved her; now she's
gone for ever!
Cordelia, Cordelia, stay a little. Ha!
What is't thou say'st? Her voice was
ever soft,
Gentle, and low, an excellent thing in
woman.
KING LEAR, *Act V, Scene* iii.

MACBETH AND LADY MACBETH

LADY MACBETH. *Why did you*
bring these daggers from the place?
They must lie there: go carry them;
and smear
The sleepy grooms with blood.

MACBETH. *I'll go no more:*
I am afraid to think what I have
done;
Look on't again I dare not.

LADY MACBETH. *Infirm of purpose!*
Give me the daggers: the sleeping
and the dead
Are but as pictures: 'tis the eye of
childhood
That fears a painted devil.
If he do bleed,
I'll gild the faces of the grooms
withal;
For it must seem their guilt.
MACBETH, *Act II, Scene* ii.

SHYLOCK AFTER HIS DAUGHTER'S FLIGHT

SALANIO. *I never heard a passion so confused,*
So strange, outrageous, and so variable,
As the dog Jew did utter in the streets:
'My daughter! O my ducats! O my daughter!
Fled with a Christian! O my Christian ducats!
Justice! the law! my ducats, and my daughter!
A sealed bag, two sealed bags of ducats,
Of double ducats, stolen from me by my daughter!
And jewels, two stones, two rich and precious stones,
Stolen by my daughter! Justice! find the girl;
She hath the stones upon her, and the ducats'.
SALARINO. *Why, all the boys in Venice follow him,*
Crying, his stones, his daughter, and his ducats.
THE MERCHANT OF VENICE, *Act II, Scene* viii.

THE SONG OF AUTOLYCUS, THE MERRY PEDDLER

Lawn as white as driven snow;
Cyprus black as e'er was crow;
Gloves as sweet as damask roses;
Masks for faces and for noses;
Bugle bracelet, necklace amber,
Perfume for a lady's chamber;
Golden quoifs and stomachers,
For my lads to give their dears:
Pins and poking-sticks of steel,
What maids lack from head to heel:
Come buy of me, come; come buy, come buy;
Buy, lads, or else your lasses cry:
Come buy.
THE WINTER'S TALE, *Act IV, Scene* iv.

SHAMROCK. "You tell us that there are three gods, and yet one," wonderingly said the natives of Ireland when the holy Saint Patrick was preaching the gospel to them 1,500 years ago. "How can that be?"

For answer the saint bent over and plucked a shamrock growing at his feet. "Do you not see," he said, "how in this wild flower three leaves are united on one stalk, and will you not then believe what I tell you, that there are indeed three persons and yet one God?"

Historians have relegated many stories about Saint Patrick to the realm of myth, but the shamrock remains the emblem of Ireland, proudly worn by Irishmen the world over on Saint Patrick's Day, March 17. The true shamrock (in Irish *seamrog*, meaning "three-leaved") is the hop clover, which much resembles our common white clover, except that the flower is yellow instead of blue-green. Large shipments of shamrocks are brought to the United States for Saint Patrick's day.

Several other three-leaved plants are loosely called shamrock, including the white clover and the wood sorrel. Scientific name of true shamrock, *Trifolium minus*. Flowers yellow, in dense head, many florets; calyx 5-toothed, 10 stamens; leaves palmately trifoliate.

SHANG'HAI, CHINA. Nowhere in the world is there another city like Shanghai. In the streets of this twin-city—for it is two cities, one European and one Chinese—the East and the West jostle each other, and, living side by side, each knows nothing of what the other is doing. The European city, in which collect merchants, missionaries, and adventurers from all the countries of the world, is clean and handsome, with splendid shops and houses, broad streets, and many trees. The Chinese city, in which herd nearly a million Chinese, is, except for a few streets, unbelievably dirty and squalid. Each city is distinct, with its own boundaries, government, and courts, so that foreigners are not subject to the laws of China.

Nearly every nation of the world has contributed its share to the cosmopolitan life of this great seaport at the mouth of the Yangtze River. The streets of the "international settlement," policed by black-bearded Sikhs from India, are scarcely less colorful than those of the native city, where Chinese from every province in the country come to transact business. Nowhere is Shanghai's strange medley of races better shown than along the wide waterfront, where European taxicabs, carts drawn by Mongolian ponies, and Chinese rickshaws, sedan chairs, and wheelbarrows await their fares.

Foochow Road in the native city is considered by the Chinese one of the most imposing thoroughfares in the whole country. It is lined with gorgeous shops and restaurants, which are so brilliantly lighted at night that the Chinese call it their "Great White Way." Of special interest to foreign tourists is the quaint old Willow Tea House, which furnished the design for the beautiful willow-ware china.

The great productiveness of the country surrounding Shanghai and its strategic position at the mouth of China's greatest river make it one of the most important seaports in the Far East. Railroads lead inland from Shanghai and 40 miles away is the Grand Canal, China's great waterway between north and south. By these routes come for export a vast amount of tea, rice, cotton, wool, beans, wheat, silk, and hides. Chief among the imports are cotton, yarns, and cloth, coal, sugar, metals, machinery, and kerosene. Shanghai has a larger commerce than all other Chinese ports. Population, about 1,200,000.

SHANTUNG (*shän-tụng'*), CHINA. On the east coast of China, looking across the Yellow Sea to Korea and Japan, lies Shantung—a mountainous promontory 100 miles wide and 200 long reaching out from the alluvial plains built of the silt brought down by the treacherous Hwang or Yellow River. Into this province, about the size of Iowa, are crowded 30,000,000 Chinese. It is one of the most densely populated districts in the world.

"East of the mountains" is what the word Shantung means. The highest of the few scattered peaks toward its western boundry, T'ai-Shan, is the most sacred spot in all China. In this province China's two most famous men were born, Confucius and Mencius, philosophers and sages.

It is the land of "shantung" and of "pongee" silk, made from the wild silkworm cocoons. Silk, coal, and iron, and the "coolie" laborer constitute its chief sources of wealth. To help the Allies in the World War, 150,000 Shantung coolies traveled all the way to the Western Front. And they did splendid work there, in salvage and construction tasks. Their keen observation of every phase of life which they saw in France broadened in turn their life of patient unending toil at home, of trying to produce three crops of rice, cotton, or millet every two years from a soil impoverished by centuries of use.

In 1897–98 Germany acquired a concession of territory in Shantung—the bay of Kiaochow and fishing village of Tsingtau—as a penalty paid her for the killing of two German missionaries. Shortly after, Weihaiwei, on the north coast of the promontory, was leased to England. Germany expended money and labor without stint and Tsingtau became a great port and military and commercial center, with golf courses, modern hotels, clean streets, and miles of the finest motor roads. The whole province came largely under German economic control. Other Shantung cities were modernized, including Tsinan, the capital, and railroads were built with German capital to connect them. The mining operations begun by Germany and continued by Japan are still in the early stages of development, but the presence of coal and iron together with a large supply of cheap labor give promise that Shantung will become one of the chief iron and steel centers of eastern Asia.

In payment for her capture of Kiaochow, during the World War, Japan demanded of China, and was given by the Peace of Versailles, the German economic concessions in Shantung—railways, mines of all sorts,

THE FORMER GERMAN CITY OF KIAOCHOW

This neat little garden city with its trim modern homes was built by the Germans when they acquired their Shantung concession in 1898. After the World War, it passed under Japanese control. It was from this port that 150,000 Chinese coolies embarked for France during the World War to work behind the battle lines.

and submarine cables, etc. All this was against the bitter protest of the Chinese. The Japanese gave a promise that all political rights in the provinces should revert to China.

Chefoo, on the north coast of the peninsula, is of steadily increasing commercial importance. Most of Shantung's silk, both raw and manufactured, is exported through this port. Because its climate is fine, as is that of Tsingtau, Chefoo has become quite a summer resort, especially liked by Europeans stationed in China.

SHARKS. Sharks are the beasts of prey of the sea, and the weapons and ferocity that seem to us so cruel simply indicate the means by which they get their living. Naturalists set the sharks (and their near relatives the rays) apart in a group of fishes called *Selachians*, the mark of which is that in them the skeleton is not bony, as in most other fishes, but its parts are composed of tough cartilage (gristle). Another notable difference between Selachians and bony fishes is that in sharks the skin is not thin and protected by a coat of scales, but is a regular hide, filled with minute flinty particles whose crowded points come through and stud the surface like fine sandpaper. This skin makes the leather called "shagreen," used as a polisher. Sharks are the lowest in rank—that is, simplest in structure—of all the true fishes; they are also the oldest in history, for their remains are found in the earliest rocks (Devonian) that have kept any fish fossils for our study. A few of the most ancient kinds of sharks are still to be found, little changed from their ancestors who swam in the Paleozoic ocean millions of years ago.

Sharks now exist in an immense variety of size, aspect, and habits. Some, like the small gray dogfish, so destructive of fishes and fishermen's nets along the northeastern coast of America, are only three or four feet long; while a certain species of the South Seas attains a length of 40 feet, and in rare instances 50 feet. Some extinct species seem to have been even more gigantic. All are more numerous in warm than cold seas, many species belonging wholly to the tropics.

Judged by habits, sharks are of two sorts. One kind, called "ground sharks," seek their food close to the bottom, but not in very deep water; while the other kind remains near the surface and captures its prey there. The former are blunt-headed, sluggish, and harmless (to us), prowling about in search of shellfish, sea-anemones, and the like, on which they feed. Their mouths are lined with rounded blocks of a hard substance called "pavement teeth," enabling them to crush and grind the hardest mollusk's shell or toughest crab. This class is the fewest in number and most ancient in character of all Selachians.

The Eating Apparatus of the Shark

The great majority of sharks are surface hunters, and swift and powerful swimmers. Their mouths do not lie at the end of the usually pointed snout, as in other fishes, but some distance back of it on the underside of the head. These mouths are large and furnished with thin sharp-pointed cutting teeth, often notched along the edge, so that the row of them looks and acts like a curved saw. In many sharks these teeth exist in several rows, one behind the other, right around the mouth; and when those in the front row are broken or fall out, the next row moves forward to take their place. Muscles of enormous strength work these horrid jaws; so that it is not surprising to learn that a small shark will chop a stout fish into pieces, or that a big one may bite a man's leg off at one stroke. The underside position of the mouth of

THE DREAD BLUE MAN-EATER, TERROR OF THE SEA

The Blue Shark (*Carcharinus glaucus*) is the common surface shark of the open seas, which follows ships on their voyages for weeks, collecting especially about whaling vessels to devour the carcasses of whales. It is slaty blue above and white underneath and more slender and graceful than most other sharks. This picture of a female shark with its young is from a group in the American Museum of Natural History, New York.

course compels the shark to turn on its back and seize its victim from beneath, but that is easy, yet has more than once been the saving of some hapless man. Some pearl-divers carry a long knife and stab the monster as it rolls over with open jaws.

Some Queer Shapes

Sharks have good eyes and noses—it is believed they can follow a line of scent in the water; but they hear little, if anything, to aid them in their hunting. One big slender fellow (the "hammer-head") has his head so broadened by two big side-lobes that it resembles the head of a hammer. Another, the "thresher," has a very long tail with which it lashes about in a school of fish until dozens of them are killed, which it then swallows at leisure. The dangerous man-eaters are mostly denizens of tropical seas and are often only nine or ten feet long. But some of the worst frequently wander northward, so that we hear now and then of a bather seized, or at least terrified, even on our own coasts, as happened a few years ago in New York Bay.

The young, produced annually, are few, and in many species are born alive. In others they come from eggs that are encased in tough and leathery envelopes. These usually bear stringy appendages that curl like tendrils about seaweeds, and so prevent the egg from drifting ashore before it hatches. These egg-cases—some of which are oblong while certain others are twisted with a spiral cone—and the similar ones of the rays are often cast up empty on the beach, and are called "sea purses."

Sharks are hunted, especially in the waters of the Far East, for the sake of the oil in their great livers, and also for the shagreen. Their flesh is used as food. Among the most common families of sharks are the following: hammerhead, *Sphyrinidae;* threshers, *Alopiidae;* tigers and "man-eaters," *Galeidae;* dogfishes, *Squalidae.*

SHAYS' REBELLION. The most important of all the disturbances in the "critical period" following the American Revolutionary War was Shays' Rebellion of 1786–87 in western Massachusetts. For six months part of that state was in armed revolt against the constituted authorities.

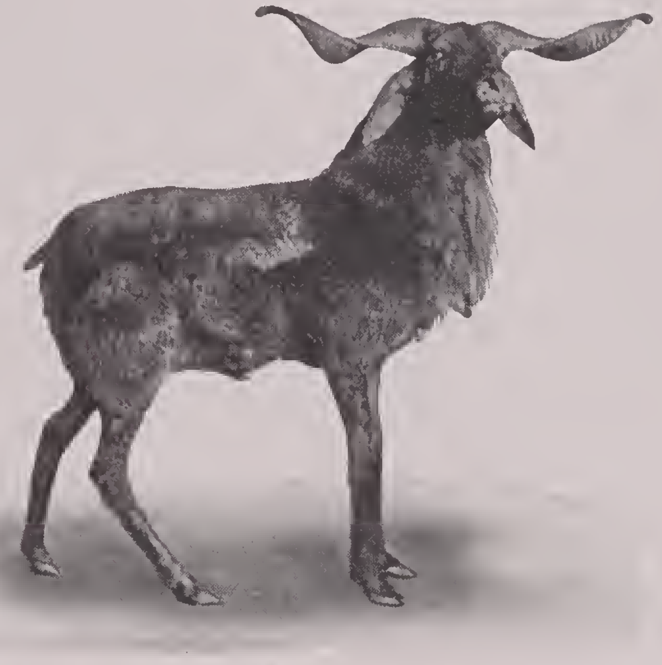
Among the things objected to by the agitators were the heavy taxation on land, the cost of law proceedings, the high salaries paid to state officials, the oppressive rulings of the courts, and the aristocratic character of the state senate. It was one of the first notable movements of democracy against aristocracy and class privilege in the history of the United States. In several towns the courts were hindered from sitting by armed mobs. The Supreme Court session at Springfield was broken up by Shays and his followers, in spite of the presence of the militia. Some concessions were made by the legislature; but the agitation was not checked until the militia fired upon an expedition which Shays was leading against the Federal arsenal in Springfield. The followers of Shays then fled, for the most part, from Massachusetts. Fourteen of the leaders were condemned to death for treason, but were pardoned. Daniel Shays himself was an honest and well-meaning man, and he was later pensioned for his services during the Revolutionary War.

This rebellion was one of several disturbances in different states growing out of the unsettled financial and political conditions following the Revolutionary War. It was also one of the chief events leading to the formation of the new constitution of the United States. The upper classes especially felt that there should be formed at once a central government strong enough "to ensure domestic tranquillity." Just grievances should be remedied, but, as Washington put it, "we should have a government by which our lives, liberties, and properties may be secured."

The ANIMAL FRIEND that GIVES US HIS WOOLEN COAT

SHEEP. There are few animals more useful to man than the sheep, and many primitive peoples would find it very hard, if not impossible, to exist without it. The sheep was among the first animals to be domesticated—perhaps it was the very first; and flocks of sheep were found in many parts of Europe and Asia before the dawn of history. The warm fleecy pelt of the sheep provides primitive men with garments for winter; its skin when properly dressed makes leather for many purposes; its wool is woven into cloth of many varieties; it yields sweet nourishing milk; and its flesh, known as lamb and mutton, is one of the finest of meats.

ABYSSINIAN MANED SHEEP



Long hair instead of wool and a longish mane distinguish the Abyssinian breed of sheep. The ram has those long spiral horns.

In the wild state sheep are found only in mountainous regions of the Northern Hemisphere. Every group of mountains in Asia possesses one or more species of sheep peculiar to it, but Europe, Africa, and America possess only one species apiece. Wild sheep are never found in lowlands. They ascend mountains sometimes to heights where no other animals except goats are found.

Sheep and goats are closely related to each other, and in the wild state are not easily distinguished by their outward appearance. Sheep differ from goats in the possession of a flat forehead, triangular horns, and no beard; they also have a tear-bag or pit beneath the inner corner of the eyes, which goats lack.

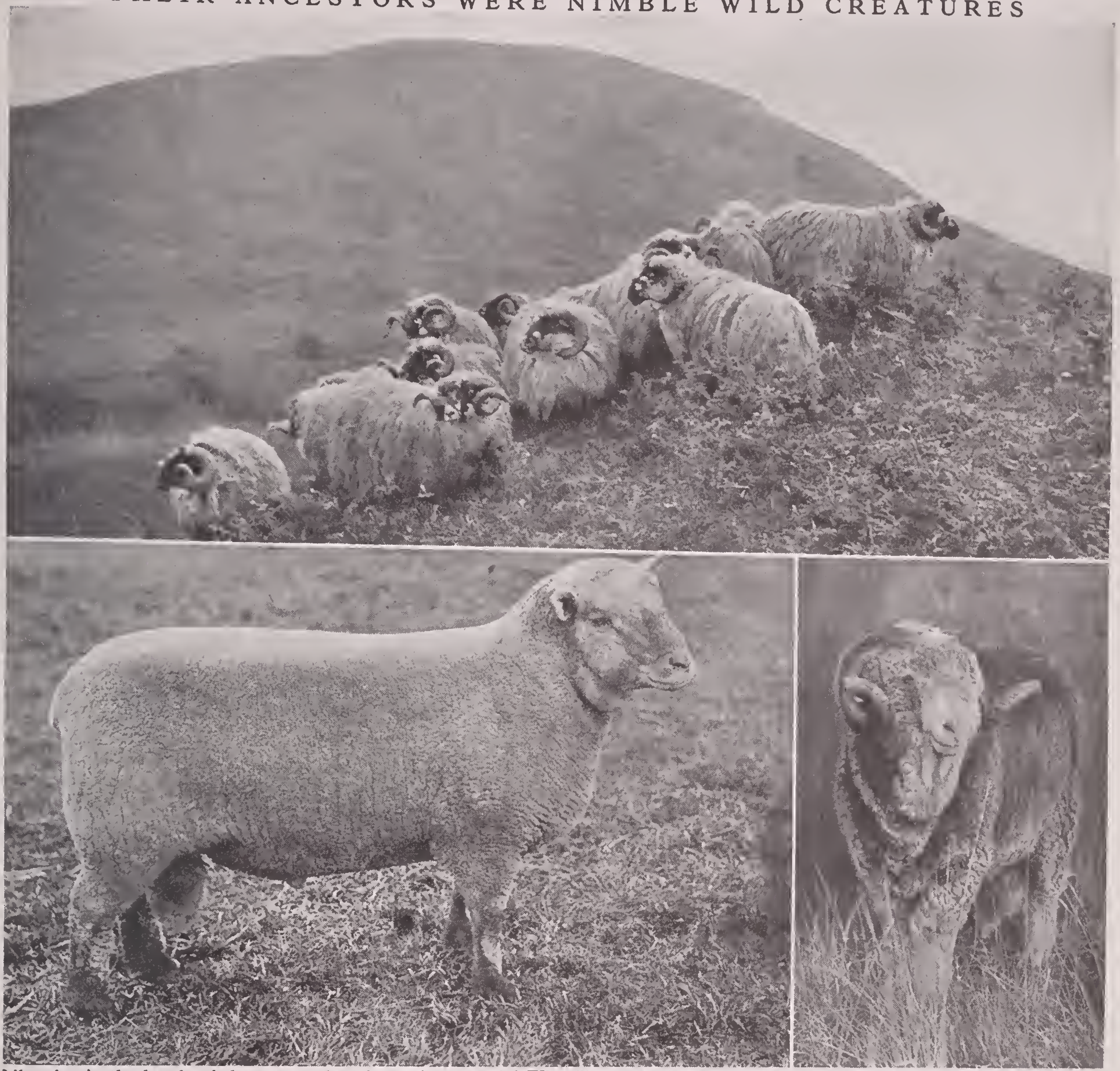
Clever Things Wild Sheep Do

Sheep live in flocks and follow a leader, usually an old ram, as the male sheep is called. They are very timid and flee at the approach of danger, but they can fight, and a large ram will even at times contest with a bull. Ewes, as the females are called, frequently charge dogs that threaten the lambs. When two or more ewes with lambs are together and are attacked by a dog, the lambs follow one of the ewes while the remaining ewes attack the dog. The dog easily dodges the charges of the sheep, but while he is so engaged the ewe and the lambs escape.

Domestication has reduced the sheep to entire dependence on man for food and protection. The timidity and cowardice of a flock of domestic sheep is pitiful. A sheet of paper blown by the wind or a clap of thunder will throw a large flock into panic. A fire in a sheepfold usually destroys most of the sheep, since all efforts to drive them out are futile. Even after they have been driven out they are almost certain to run back into the burning building unless prevented from doing so. The lambs, one or two at a birth, are born in the spring, and are capable of following the mother soon after birth.

The bighorn, or Rocky Mountain sheep, of North America is one of the largest varieties of wild sheep (*see* Bighorn). There are several allied species, some of them in Asia. It seems probable that all the wild sheep in Asia and America are closely related, although there are great differences in size and color. The mouflon, the only representative of the sheep family native to Europe, is found on the islands of Corsica and Sardinia. The aoudad, or Barbary sheep, is found in northern Africa, in the Atlas Mountains. It is a large animal, resembling the goats. It has large horns and a manelike growth of long hair on the breast and forelegs. The argali of Mongolia, whose

THEIR ANCESTORS WERE NIMBLE WILD CREATURES



Like clay in the hands of the potter, the wiry, agile, graceful Wild Sheep has been molded to suit human convenience—into the many woolly, short-legged, clumsy breeds of Domestic Sheep. Above is a group of Scotch Blackface Sheep, which make excellent mutton but produce an inferior grade of long, coarse, hairy wool. Below, to the left, is the aristocratic pure-bred Sussex or Southdown, with its fine short fleece. On the right is a Merino ram. The Merinos are not good mutton-producers, but are considered the greatest wool-producing breed in the world.

enormous spreading horns are a wonder to all beholders, and the "Marco Polo sheep" of the Pamir plateau, whose horns though less massive have a wide spread, are the largest members of the sheep family. The latter gets its name from the famous Venetian traveler of the 13th century, who first described it.

There are several other varieties of wild sheep in Asia, such as the sha or urial, which has a wide range in southern Asia; the burrhel or blue sheep, which is found in the Himalaya Mountains; and the sair whose range is in the Altai Mountains. The burrhel possesses many points, particularly its smooth horns, in common with the goats and seems to be a connecting link between the goats and the sheep.

The origin of the domestic sheep is unknown, but it is almost certain that several, and perhaps many, varieties of wild sheep were tamed, and that the modern varieties of domestic sheep are the result of cross-breeding. However this may be, it is noteworthy that the domestic sheep bear little resemblance to any of the existing wild species. For example, most of the domestic breeds are hornless, though some have developed four and even eight horns, and nearly all bear wool instead of the coarse hair of the wild sheep.

The commonest and best known of the domestic breeds is the Merino, which originated in Spain in the 15th century. It is famous for the large quantity and fine quality of wool it produces. The Merino has been used to improve most, if not all, of the other European short-wool breeds.

In the beginning of the 19th century Merino rams were imported into America, often at fabulous prices, and the flocks gradually spread westward over the fertile lands of the Great Lakes region, and southward to the Ohio. When the land in this region became too valuable to make the sheep industry profitable at the prevailing prices of wool, large flocks were established throughout the west, from Montana to Texas, and over the Rocky Mountains to the Pacific coast. More than two-thirds of the sheep of the United States are found west of the Mississippi. Since 1910 the number of sheep in the country has steadily decreased, despite the great advance in the price of wool and mutton.

The Best Wool in All the World

The American Merinos produce the best wool in the world, and for many years this breed predominated, but gradually the demand for a better mutton-producing sheep than the Merino resulted in the introduction of various English breeds. Among these the Cotswold was long a favorite, but many other varieties were imported from time to time, and flocks of Southdowns, Shropshires, Hampshires, and Oxford Downs are now found in many parts of the country. They produce wool of medium and long fiber. The "improved Leicester," developed in England, is the progenitor of most long-wool breeds, such as Lincolns and Cotswolds.

The Delaine Merino, from which the fine Delaine wool is derived, is an American product; the breed was developed in western Pennsylvania and eastern Ohio. "Saxony," another popular wool of excellent quality, is derived from Merino sheep which were introduced into Saxony from Spain. The Rambouillet breed, which originated in France and is a descendant of the Spanish Merino, is larger than the Merino and has recently become popular with American sheep-breeders. The Cheviot is a Scottish mountain sheep producing a medium-length fine wool.

The fat-tailed sheep, found in many parts of Africa and Asia, is remarkable for the quantity of fat which accumulates in its tail; in some instances the tail weighs from 50 to 80 pounds. The shepherds fasten a board to the underside of the tail, and sometimes attach wheels to the board to enable the sheep to carry its tail without injury. The fat is highly esteemed as a delicacy and is often used instead of butter. The new-born lambs of other Asiatic sheep, such as the Astrakhans and Karakul breeds, have a very fine wool twisted in spiral curls which is in high demand as fur.

The chief sheep-raising countries of the world are Australia, Argentina, Russia, the United States, South Africa, India, the British Isles, Uruguay, New Zealand, and Spain. (*See also* Wool.)

Sheep belong to the genus *Ovis*, of the family *Bovidae*. The domestic sheep is *Ovis aries*.

SHEFFIELD, ENGLAND. All over the world "Sheffield" means fine cutlery, such as knives, razors, scissors, surgical instruments, together with mathematical instruments, files, saws, and engineering tools of all kinds. Heavy steel, too, is manufactured there—armor plate, rails, engines, machinery, guns and shells—and cast-iron articles, such as stoves and grates, as well as silver and brass ware. Next to the mayor, the highest dignitary in town is the Master Cutler of the ancient Cutler's Company, which exercises jurisdiction over trademarks on metal goods and over all persons in business in the district of the West Riding of Yorkshire, in which Sheffield is situated. The famous "Sheffield plate" (silver) is no longer manufactured, the process having been abandoned in favor of cheaper methods.

Sheffield's preëminence in the steel industry is due in part to its situation in the Yorkshire-Derbyshire coal field; yet iron was smelted with charcoal in the district probably in Roman times—certainly by the time of the Norman Conquest—and Sheffield blades were famous long before "pit coal" was used in the manufacture of iron and steel. The Miller in Chaucer's 'Canterbury Tales' carried a "Sheffield thwytel" or knife. It was a Sheffield man, Benjamin Huntsman, who in 1740 introduced the process of making crucible steel from bar or blister steel, which is still used in making Sheffield fine cutlery. Henry Bessemer established his first steel works in Sheffield, by the aid of Sheffield capital, and much Bessemer steel is still manufactured there.

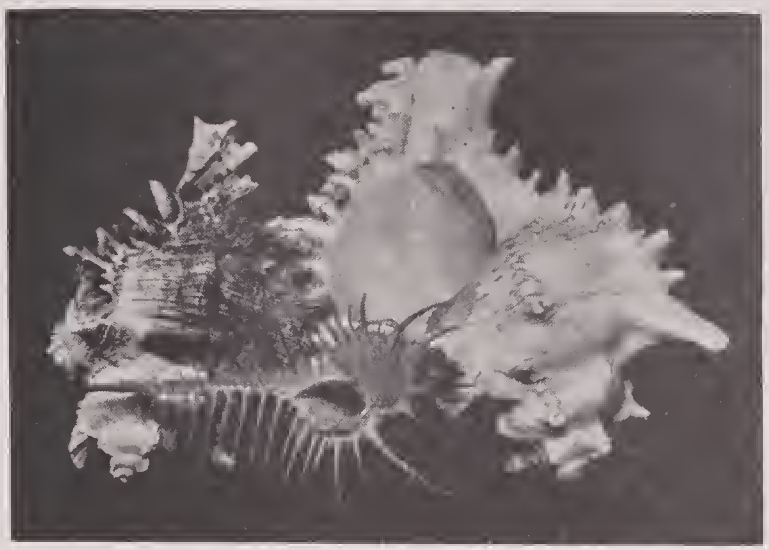
Like some of the Pennsylvania steel towns, Sheffield is smoky and dirty, but it is delightfully situated at the base of hills on the river Don, a tributary of the Humber. Its most interesting public building is St. Peter's Church, originally built in Norman times and burnt during the wars of Edward III with the barons, but rebuilt; the oldest standing part, the tower, dates from the 14th century. Sheffield University, founded in 1905 by a local steel manufacturer, comprises, besides the departments of medicine, arts, science, commerce, etc., a flourishing technical school with metallurgical laboratories and shops. Population, about 495,000.

SHELL. Among the many things which make the seashore a place of wonder and delight are the shells, of the most curious and interesting shapes, with which it abounds. Some, washed up by the tide, are empty; but others contain the living tenants, which often rival the shells in interest.

But shells are not confined to the seashore. They are found in all parts of the ocean, sometimes buried in the mud and ooze of the ocean bed, or floating airily on the surface of the water a thousand miles or more from shore; and the dim quiet of the Arctic waters and the brilliant shimmer of the tropic seas alike conceal their millions of interesting creatures. Nor is it necessary to go to the sea for shells, for they abound in fresh-water ponds and streams and on land. They are even found in the desert beds of dried-up seas, on lofty mountains, and far down in the depths of the earth, giving their mute witness to the life of long-past ages.

Shells as we know them are the coats of armor that mollusks and other animals form to protect themselves. The shell is composed of substances secreted by the glands of the animal's back. It consists largely of carbonate of lime, which is the basic material of limestone, chalk, and marble; and lime is often obtained commercially by burning piles of shells. As the animal grows in size, its shell increases in thickness and extent. The lines of growth are usually clearly marked by the ridges running parallel to the outer or free edge, as in the oyster and clam. The other ridges and protuberances on a shell are caused by corresponding projections on the "mantle," or muscular tissue which grows from the back. (*See* Mollusks.)

THE BEAUTIFUL MUREX



These shells are from mollusks of the *Murex* genus, remarkable for the beauty and variety of their spines and still more so for the fact that some of the animals yielded the famous "royal" or "Tyrian" purple of the ancients.

The Shell Creature's Triple Coat

The mollusk shell consists of three layers. The outer surface is covered with a thin layer of hornlike material which contains no lime. Beneath this is a layer of very small prisms of carbonate of lime. Lastly, forming the internal layer, is the nacre, or "mother-of-pearl," composed of alternate layers of carbonate of lime and a horny substance arranged parallel to the surface. The free edges of these layers refract the light and thus produce the beautiful iridescent appearance which we prize so highly. The outside of the shell may be white, black, brown, tan, purple, red, or rose, but usually some pattern combining several colors, tints, or shades. The color of the interior is usually paler and more delicate than the exterior, and often it is splendidly prismatic. Shells of the tropics are usually more highly colored than those of temperate zones.

The Scorpion shells have long curved fingers that make them look like the animal for which they are named.

When you look at a collection of shells you are amazed at the infinite variety of shapes represented. Many of them so closely resemble other natural objects or objects of human invention, that they are known as "miter," "harp," "helmet," "top," "razor," "turban," "cone," "basket," "lamp," "frog," "trumpet," "ear," and "slipper" shells. Most are marked with ridges, folds, frills, or spines, corresponding to the growth or structural peculiarities of the animal that lived in them.

But despite the great variety of these forms, you will soon notice that they nearly all fall into one of two great groups—those having a shell in one piece, like the snails, and those having a shell in two pieces hinged at the back, like the oysters and clams. The one-piece shells are called "univalves" and the two-piece shells "bivalves." All the land shells are univalves, but the shells found in the water may be either univalves or bivalves. Besides these two great classes, there is another kind which is much less common, in which the shell consists of eight overlapping plates connected by a leathery girdle. These "coat-of-mail" shells, the chitons, are found wholly in salt water. They cling to the rocks with extraordinary force, and when they are dislodged they promptly curl up like a pill bug, and must be put in salt water or on a moist surface before they will relax.

Among the common bivalves found on or near the seashore are the oyster, clam, mussel, scallop, cockle, razor shells, and the teredo or shipworm. All of these are mollusks, but other interesting bivalves which are not mollusks also live near the shore, usually in deep water. These are the "lamp shells," or brachiopods, which are really shelled worms.

Lamp shells are among the oldest of animal groups. Millions of years ago they were more abundant than now, but in structure they are nearly the same as then. The larger of the two valves resembles the bowl of an ancient lamp, and the circular hole at one end seems to be made for a wick. But the hole is really used to help fasten the animal to some anchorage, for through it runs a long stem. Lamp shells vary in size from two inches to a sixteenth of an inch in length. In color they are waxen white, brown, or brilliant crimson.

The largest of the shells is the giant clam of the Indian and Pacific Oceans, which grows to be from two to three feet in diameter and sometimes weighs four hundred pounds. Single valves of these shells are sometimes used as receptacles for holy water at the doors of Catholic churches. So hard do the shells become that the natives of the Caroline Islands hew axes out of them. Divers for pearls and sponges are said to have been trapped by this great shell, and to have cut off hand or foot as the only way to escape drowning.

Most of the univalve shells are more or less conical in shape, though sometimes they are much flattened. The snail and whelk class have conical tubes coiled in a spiral, usually from left to right. Another class is shaped like a hollow cylinder, open at both ends, and looking much like an animal's tooth, whence they are called "tooth shells."

Everyone is acquainted with the beautifully conical shape of the conch shell, found on the Florida coast and the West Indies. The "queen conch" is the largest shell native to any part of the United States, sometimes measuring a foot long. These shells are used for parlor ornaments, and for dinner horns on Southern plantations. Loads of them are shipped yearly to Great Britain to be ground to pieces and used in the manufacture of porcelain.

SUCH BORES!

Bivalves have various accomplishments. Some can swim, some jump, some burrow. These Piddocks are borers in solid stone.

Because of their beautiful coloring, many shells are manufactured into articles of adornment, such as brooches, bracelets, necklaces, and buttons (*see* Buttons); or they may be used for inlaying furniture, musical instruments, and other articles. Among those much in demand for such purposes is the abalone or "earshell," found in greatest perfection on the shores of California, where it sometimes grows ten inches long. This shell is a true spiral, but it is flat and therefore often mistaken for a bivalve. The inside is beautifully iridescent, and the exterior also takes a high polish. From these shells comes a large part of the mother-of-pearl of commerce, and great quantities are gathered annually for making pearl buttons. They cling to the rocks with terrible power and many a lonely fisherman has been drowned, it is said, by getting his fingers caught between the shell and the rock.

The beautiful "turban shells" from the Indian Ocean, the Philippines, and the Sea of Japan are also in great demand for making buttons and ornaments. They are large heavy shells, with rounded whorls shaped like a turban. The giant of the family is the "green turban" or "green snail," which the monarchs of Scandinavia used to mount in silver and use for drinking cups. The "Turk's cap" is a beautiful variety, from three to five inches across.

SCREW SHELL

A little spiral tower of strong and beautiful design.

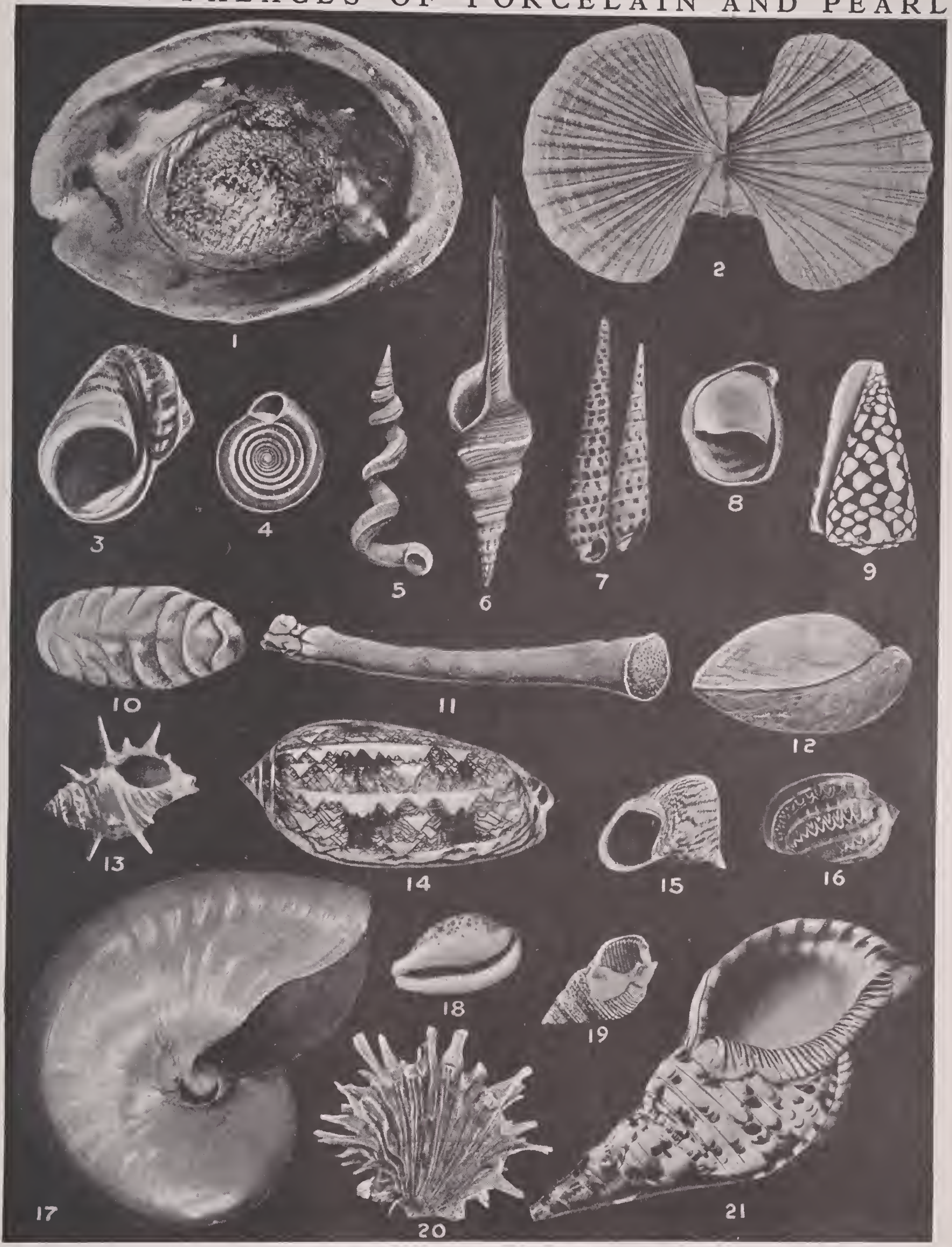
The "helmet shells" are notable for their use as cameos. They have a dark coat under a pale outer layer, so that figures carved on them stand out in bold relief against the black, red, pink, or orange background. The best for this purpose is the "black helmet," which is found on the Atlantic coast from North Carolina to the West Indies. Formerly all cameos were cut from stones, but many of the finest specimens of the last century have been cut from these shells (*see* Cameo).

Among many primitive peoples, as among the North American Indians, shells were used for money. The most widely used shells for this purpose are the beautiful cowries or "Venus shells," which exhibit an endless variety of color and shape. The "ringed cowry" is still the usual currency in a few of the more remote of the Indian and Pacific islands, and some tribes in the interior of Africa use strings of the "money cowry." Along the west coast of Africa this was the usual currency until past the middle of the 19th century, and traders made large fortunes by gathering these shells in the Indian or Pacific Oceans and exchanging them for ivory and other valuable goods in Africa. Where they are still used, their value ranges from 2,000 to 3,000 shells to the dollar. In one of the tribes of Africa the king's revenue was estimated at 30,000,000 shells a year, and from 20,000 to 60,000 cowries was the price of a wife.

The currency of the American Indians, known as "wampum," consisted of cylindrical fragments of quahaug, whelk, and periwinkle shells, rubbed smooth on stones and strung like beads on fine strands of skin. The white beads were generally rated at only half the value of the purple beads, made from the quahaug or hard clam. A six-foot string was worth from five to ten shillings. Wampum was the accepted medium of trade with the Indians until well into the 18th century, and a belt of wampum was given to bind every treaty. Necklaces and belts of wampum were also used as ornaments.

Shells, properly so called, are to be distinguished from the hard shield which covers such animals as the tortoise, the lobster, and the crab. This thick crust is called a "carapace," and is a thickening of the skin rendered solid by deposits of the same carbonate of lime of which mollusk shells are formed, and intermediate between shell and bone in general composition and character.

WATER PALACES OF PORCELAIN AND PEARL



Here are shells from far and near: 1. Abalone or Ear Shell. 2. Crusader's Scallop. 3. Turk's Cap. 4. Coil Shell of the Pond Snail. 5. Worm Shell. 6. Distaff Spindle. 7. Two Auger Shells. 8. Arched Slipper Shell. 9. Marbled Cone Shell. 10. Showy Chiton. 11. Watering Pot Shell. 12. Fossil Lamp Shell. 13. Spiny Frog Shell. 14. Camp Olive Shell (see the tents!). 15. Tiger Top Shell. 16. Harp Shell. 17. Pearly Nautilus. 18. Tiger Cowry. 19. Channeled Basket Shell. 20. Painted Thorny Oyster. 21. Great Triton or Triton's Trumpet.

SHELLEY, PERCY BYSSHE (1792–1822). "A beautiful and ineffectual angel, beating in the void his luminous wings in vain"—so the great English critic Matthew Arnold characterized Shelley. The poet of clouds and sunsets and rainbows, of the swift wind, of the blue depth of the boundless sky, of the soaring skylark, Shelley seemed more at home in the heavens than on the earth. And still the great purpose of his life was not to soar among the clouds and write beautiful poetry. His ruling passion was to make the world better, to free mankind, "to purify life of its misery and evil." His work was ineffectual, for his schemes for reform were impractical and he knew little of real life; and in this lies the tragedy of his life. As a reformer he is almost forgotten; while as a poet he ranks among the highest in English literature. This is not the fame he desired.

A Dreamy and Romantic Figure

Even as a small lad Shelley was different from other boys. He was a beautiful youth, of slender figure, with complexion as fair as a girl's, and luminous large blue eyes, at times soft and dreamy, and at other times lit up with a wild and restless brilliance. Tales of romance and mystery fascinated him, and he delighted no less in the wonders of science, almost killing himself in chemical experiments. But his schoolmates could not understand why he took no interest in their games of cricket and football, and they called him "mad Shelley."

He imbibed the spirit of the French Revolution, which was still in the air, and rebelled against the tyranny that he saw everywhere, in government, in society, and in religion. He was expelled from Oxford University for writing an attack on religion, and his father, a baronet of an old Sussex family, understanding him as little as did the rest of the world, cast him off. Though without means, Shelley married a girl of 16, out of pity, because he felt that she, too, was oppressed and misunderstood. Shortly afterward he went to Ireland and tried to arouse the Irish to a sense of their wrongs, but without success.

His Tragic Death in the Sea

In 1818 he left England for Italy, where he spent the remainder of his life. In the meantime his first unhappy marriage had ended tragically, and he had married again, this time finding sympathy and understanding. During these years he wrote his beautiful poetic drama, 'Prometheus Unbound', and those matchless lyrics, 'The Cloud', 'To a Skylark', and 'Ode to the West Wind'. Here, too, he wrote his wonderful elegy, 'Adonais' on the death of his brother-poet John Keats, little knowing how soon his own life was to be cut short. He was drowned while sailing with a friend off the coast of Leghorn, a little more than a year after he had written these sadly prophetic lines:

> The breath whose might I have invoked in song
> Descends on me; my spirit's bark is driven,
> Far from the shore, far from the trembling throng
> Whose sails were never to the tempest given;
> The massy earth and sphered skies are riven!
> I am borne darkly, fearfully, afar;
> Whilst burning through the inmost veil of Heaven,
> The soul of Adonais, like a star,
> Beckons from the abode where the Eternal are.

In addition to those mentioned, Shelley's chief long poems are: 'Queen Mab' (1813); 'Alastor, or The Spirit of Solitude' (1815); 'The Revolt of Islam' (1817); 'The Cenci', a tragedy (1819); and 'Epipsychidion' (1821). Among the shorter poems are: 'Hymn to Intellectual Beauty' (1816); 'Mont Blanc' (1816); 'Ozymandias' (1817); 'Lines Written among the Euganean Hills' (1818); 'The Indian Serenade' (1819); 'The Sensitive Plant'; 'Arethusa' (1820); 'To Night' (1821).

SHERIDAN, GENERAL PHILIP HENRY (1831–1888). "Fighting Phil Sheridan" ranks with Grant and Sherman as one of the three great generals on the Union side during the War of the Rebellion, and he was the only one of the three who devoted his whole life to the profession of arms. Born in New York of Irish parents, Sheridan had secured as good an education as was afforded by the schools of the frontier state of Ohio, to which his parents had removed soon after his birth. Sheridan was ambitious and determined to succeed in life, and the outbreak of the Mexican War fired his ambition to be a soldier. He accordingly secured an appointment to West Point from which he was graduated in 1853. His first actual experience in warfare was gained in campaigns against the Indians in Texas and Oregon.

At the outbreak of the Civil War he was a first lieutenant, but, owing to the distinguished service which he rendered, his promotion was rapid, until he reached the rank of major-general of volunteers. His first services were in the West, where he distinguished himself in the battles of Perryville, Stone River, Chickamauga, and Chattanooga. At the battle of Missionary Ridge Sheridan led the men who charged up the hill, and he was one of the first to reach the crest.

When Grant, who had witnessed Sheridan's exploit at Missionary Ridge, was placed in command of the United States army, he gave Sheridan command of the cavalry of the Army of the Potomac. During the Wilderness campaign of 1864, Sheridan aided Grant by harassing the enemy and cutting their lines of communication.

In July of that year, when a strong Confederate force under Early had defeated the Federal army in the Shenandoah valley, penetrating into Maryland and threatening Washington, Grant saw the necessity of putting the department in the hands of an able general, and in August he placed Sheridan in command in the Shenandoah, with instructions to drive the Confederates out of the valley. So well did Sheridan succeed in carrying out these instructions that he put an end to the war in northern Virginia. He attacked Early at Winchester and again at Fisher's Hill, defeating him at both points, capturing 5,000 men and many guns, and pursuing him to Staunton. In recognition of this service Sheridan was made a brigadier-general in the regular army. Early's army receiving large reinforcements from Lee, again advanced into the valley, surprised the Federal army at Cedar Creek in the early morning of October 19, and drove them back in confusion. Sheridan was absent from the army, having been to headquarters in Washington. He reached Winchester, 20 miles from Cedar Creek, on his return when he heard—

> The terrible grumble and rumble and roar,
> Telling the battle was on once more.

Hurrying forward, he reached the field. Speedily forming a line to stop the stragglers, he rode forward waving his hat and shouting, "Face the other way, boys; we are going back." Confidence was restored, the lines re-formed, and at 3 p.m. they moved back upon the enemy. The result was the total rout of Early's army, which was pursued up the valley for 30 miles. For this victory Sheridan was promoted to be major-general in the regular army, and received the thanks of Congress. The spirited statue in Washington by Borglum represents him at the moment when he is rallying his men on the Winchester road.

After devastating the Shenandoah valley, the granary of the Confederacy, so that it was said that a crow flying over it would have to carry its rations with it, Sheridan returned to the Army of the Potomac in March 1865. He was conspicuous under Grant in the operations before Petersburg and in the final battles preceding Lee's surrender. He compelled the evacuation of Petersburg by his superior generalship at Five Forks, where he entrapped and routed the Confederate troops under Pickett, capturing more than 5,000 prisoners.

After the close of the war Sheridan was placed in command in the Southwest near the Mexican border, where his benevolent attitude helped the Mexican patriots in their struggle against Emperor Maximilian, and later, of the department of Missouri, with headquarters at Chicago. When Sherman was made general, Sheridan was made lieutenant. He was the American military observer with the Prussian army in its invasion of France in the Franco-Prussian War in 1870. After Sherman's death the rank of general was conferred on Sheridan a few months before his own death. He was the last to hold this rank until it was conferred on Pershing.

As a field commander Sheridan was unapproachable. Filled with the ardor of battle, so that it was said he raged like a lion, his skill equaled his courage. He never lost a battle; and stood, after Grant and Sherman, one of the greatest Northern generals. Grant said: "As a soldier there is no man living greater than Sheridan. He belongs to the very first rank of captains, not only of our army, but of the world. I rank him with Napoleon, Frederick, and the great commanders of history."

SHERMAN, GENERAL WILLIAM TECUMSEH (1820–1891). Scarcely second to General Grant in bringing to a successful close the military operations of the Civil War was William Tecumseh Sherman, a brother of the statesman, John Sherman. Like Grant he was born in the then frontier state of Ohio a few years after that region had been freed from the menace of the Indian chief Tecumseh, and was named in memory of that noble warrior. Although the boy was left fatherless at an early age, he enjoyed greater educational advantages than did most boys of his time, due to the kindness of his father's friend, Thomas Ewing. After he had finished the academy in his home town of Lancaster, Ohio, he secured an appointment to the military acadamy at West Point, and was graduated from there in 1840 near the head of his class. He was immediately given an appointment in the United States army, and during the Mexican War saw active service in California. By the end of that war he was tired of military life, and resigned his commission to enter on a business, legal, and educational career. At the opening of the War of Secession we find him at the head of the state military academy of Louisiana. But his sympathies and duty lay with the North, so resigning his position, he hurried to Washington to offer his services to his country. The offer was accepted, he was commissioned a colonel, and commanded a brigade in the first battle of the war at Bull Run.

GENERAL SHERMAN

When the plans for the conduct of the war were matured, in August 1861, it was decided to send Sherman—now a brigadier-general—to the West, where he was placed in command of the Department of the Ohio. Immediately on taking charge of the department he reported to Washington that 200,000 men would be needed to carry on the campaign in the Mississippi valley. The North at that time had no adequate idea of the immensity of its task, and the papers said that Sherman was "crazy." Time proved that his estimate was correct, but he was sacrificed for the moment to the popular clamor against him and removed from his command.

Sherman's military genius was so great that he could not long be kept in the background. At the battle of Shiloh, April 6, 1862, he was in the thick of the fight. He had three horses shot from under him and was twice wounded, but he helped save the day for the Union army. For his services he was given the rank of major-general. Serious mistakes had been made at the battle of Shiloh, and the commander, Grant, had to endure much criticism. Grant wished to withdraw from the army entirely, but Sherman persuaded him to stay, reminding him of the storm of criticism he himself had weathered.

Sherman did more than talk. He backed up his words with deeds, and in the Vicksburg campaign rendered valuable aid to Grant. At its successful conclusion he generously gave all the credit to his superior officer. When Grant, as a result of this campaign, was made commander of the armies of the United States, Sherman was appointed to fill Grant's position as commander in the West.

His Most Famous Campaign

It was in this position that he carried on the campaign on which his fame chiefly rests. On May 6, 1864, he left Chattanooga, Tenn., for Atlanta, Ga. It took him four months to cover the 135 miles between the two places, for in this campaign he met a foeman worthy of his steel in Gen. Joseph E. Johnston, the Confederate commander. Difficulties were about evenly balanced, but Sherman possessed the love and confidence of his men to a much greater degree than did his opponent. They knew that when they saw "Uncle Billy and his white socks" all was well.

Atlanta was reached on September 2. After clearing the city of its civil population and resting his men, Sherman started on his famous march of 400 miles "from Atlanta to the sea." For 32 days no news of him reached the North. He had cut himself off from his base of supplies, and his men lived on the country through which they passed. They covered a path 60 miles wide in their march, and in that path everything which they could not use but which might prove of use to the enemy was ruthlessly destroyed. When we consider this destruction is it any wonder that Sherman said that "war is hell"? Finally on December 20, Savannah, Ga., was reached and Sherman telegraphed to President Lincoln: "I beg to present you as a Christmas gift the city of Savannah, with 150 heavy guns and plenty of ammunition, and also about 25,000 bales of cotton."

The Surrender of Johnston

After a month's rest Sherman turned North with his army, expecting to join Grant near Richmond, the Confederate capital. But before he reached that place the Confederacy had collapsed. After receiving the surrender of General Johnston in North Carolina, Sherman marched on to Washington. He thus completed a march of nearly 2,000 miles through the enemy's country, one of history's greatest campaigns.

Having achieved such fame in the army, Sherman decided not to return to civil life. He remained as commander in the West until Grant was elected president. He was then made commander of the United States army, and given the rank of general, a rank which previously had been held only by Washington and Grant. He held the command of the army until 1884, when he resigned, after 23 years of continuous army service.

SHETLAND ISLANDS. In that far-away time when the Shetlands were inhabited by a short dark people called the Picts, the Romans named the islands *Ultima Thule*, "the farthest land," or end of the world. But to the Vikings of Norway and Sweden these northern outposts of the British Isles were near neighbors, a new kingdom where their "jarls" could taste of the fierce joys of piracy and feasting and combat. On every hand the traveler is confronted by some reminder of these ancient times—a burial mound, where the people of the Stone Age laid their chieftain to rest; a mysterious stone circle, marking the scene of some ancient Pictish rites; or a crumbling tower, a stronghold of this vanished race.

But there is also the charm of the present in this land of rolling seas and sweeping winds, where the waves dash like a charge of plumed cavalry against the high and brilliantly colored cliffs and have carved out from solid porphyry rock a great staircase known as Grind of the Navir, or Gate of the Giants. Everywhere is the sight or sound of the sea, for even the largest island is so broken by bays that no point is more than three miles from the ocean.

These are the compensations of the Shetlanders for their fogs and storms, their long dreary winter, and the bare and rugged isles where there are scarcely a hundred trees, and where little except potatoes, and scanty crops of oats and barley can be grown. Fishing has always been the leading industry, supplemented by the raising of cattle and sheep and the well-known Shetland ponies. Some woolen goods are manufactured from the fine Shetland yarns.

Situated 120 miles northeast of the mainland of Scotland, and about 200 miles west of Norway, the Shetlands number about 100 islands, of which approximately one-fourth are inhabited, and cover about 550 square miles. The most important is Mainland, which contains about two-thirds of the total area of the islands, and has at Lerwick, a thriving seaport, one of the finest natural harbors in Great Britain. The group was ceded by Norway to Scotland in 1468, and constitutes a Scottish county. Population, about 26,000.

SHILOH (*shī'lō*), **BATTLE OF.** On Sunday morning, April 6, 1862, General Grant was sitting at breakfast at his headquarters in southwestern Tennessee when he heard the rumble of cannon in the distance. He set down his coffee-cup half emptied and hurried away to the fiercest battle thus far fought in the Civil War, that of Shiloh or Pittsburg Landing on the Tennessee River. When he reached the vicinity of the little log church of Shiloh he found a serious situation. Gen. A. S. Johnston, the Confederate commander, had suddenly attacked the Union troops that morning with superior forces, surprised and captured their scattered outposts, and then engaged the main body. The Union resistance during the day was stubborn, but after 12 hours of fighting they were driven from all but one of the positions which they had held in the morning when the conflict began. The Confederates, however, had sustained an irreparable loss in the death of General Johnston.

That night both sides slept on the battlefield, ready to resume the conflict as soon as it was light.

Under cover of the darkness fresh troops joined Grant's worn-out command, and on the next day the Union forces regained all that had been lost on Sunday. The Confederates fought stubbornly, but they were finally forced to withdraw, and the victory remained with the Union forces. But it was a victory bought at the terrible cost of 13,000 Northern men killed and wounded. The price was too great for the advantage gained, and the criticism showered upon General Grant was so bitter that President Lincoln was urged to remove him from his command. Fortunately the President stood loyally by his general, with the result that the blunder of Shiloh was soon redeemed by the success at Vicksburg.

OARS, SAILS, and STEAM— The CONQUEST of the SEA

How the Ship Which Discovered America Compares with a Modern Liner

UNTOLD thousands of ships, plying across the seas for thousands of years, have woven the countries of the world together in an intricate web. From the lotus-tai'ed Egyptian galleys, and the gay-sailed craft of the Phoenician mariners—

Their hulls were heightened, their sails spread out,
they grew with the growth of their quest;
They opened the secret doors of the East,
and the golden gates of the West,
And many a city of high renown
was proud of a ship on its crest.

From these ancient beginnings down to the proud steel leviathans of today, ships have disseminated knowledge, multiplied wealth, built up national power, and, above all, have slowly wrought a solidarity of human interest.

SHIPS. Picture the *Santa Maria*, Columbus' flagship, lying alongside one of the giant liners of today, say the *Olympic*, which measures about a city block and a half in length—ten times as long as the *Santa Maria*. Passengers and crew, the *Olympic* carries in luxurious comfort more than 3,000 people—about 50 times as many as endured the misery of that first transatlantic passage crammed in the *Santa Maria's* hull. "Great as my respect for Columbus had always been," said a modern naval officer, "it was greatly enhanced when I saw the thing, like half a man's tall-hat case, in which he sailed out into the unknown." The *Santa Maria*, it has been calculated, displaced 200 tons of water. The *Olympic* displaces 60,000 tons—300 times as much. Yet there is an interval of only a little over 400 years between the *Olympic* and the caravels of Columbus, while back of the latter stretches a shipbuilding experience extending over more than 4,000 years.

The Egyptians, early accustomed to water travel by their one great thoroughfare, the Nile, were apparently the first people to construct vessels large enough to deserve the name of ships. Egyptian paintings as early as the middle of the 28th century B.C. show large seagoing vessels propelled by oars (as many as 26 on a side) and sails, and with four or five steering paddles (*see* Transportation). The ancient Cretans (*see* Aegean Civilization) seem to have been the first people to build up an extensive maritime empire, but the first great improvements in ships came from the greatest mariners of ancient times, the Phoenicians, whose merchant vessels were trafficking in distant lands by about 1000 B.C. The Phoenicians constructed galleys with two and three banks of oars, thus gaining speed without increasing the size of the vessels. The Greeks and Romans made these "biremes" and "triremes" formidable engines of war by adding sharp beaks for ramming enemy ships.

Long before the break-up of the Roman empire, a race of the hardiest seamen the world has ever known, venturing out from the Scandinavian fiords in their narrow shallow one-masted "serpents" and "dragons" with single oar-banks, were preparing to scour the then known world and to enlarge it by discoveries beyond the unknown western seas (*see* Northmen). As the discovery of America and of the route around the Cape of Good Hope drew commerce away from Venice and the other trading cities of the Mediterranean basin, while the introduction of the mariner's compass rendered ocean navigation safer, the new Atlantic sea-powers—Spain, Portugal, the Hansa towns, the Netherlands, and England—developed new types of vessels, such as the caravel and the galleon, rising high out of the water and with lofty "castles" at bow and stern. Sails became ever more important as shipping ventured out upon the Atlantic, though fighting vessels of the Middle Ages continued to rely on oars for propulsion when in action. War galleys attained greater speed by the use of tremendous 50-foot oars, supported by framework standing out at each side of the hull, and each oar pulled by three to seven men. The oared war-galley manned by convicts or prisoners of war survived down to the 17th century.

Sailing vessels of Columbus' time might carry from one to three masts. The rudder, which from ancient days had been a huge oar carried over the right side (whence "starboard," from "steerboard," for the right side of the ship), had long since assumed its more modern form and been placed in the middle of the stern, with a "tiller" or bar handle (later replaced in all but the smallest craft by a wheel) for control. A 1,600-ton ship of 1592 was notable for its size; it was 165 feet long—not quite so large as the Roman grain ships of the 2d century A.D.

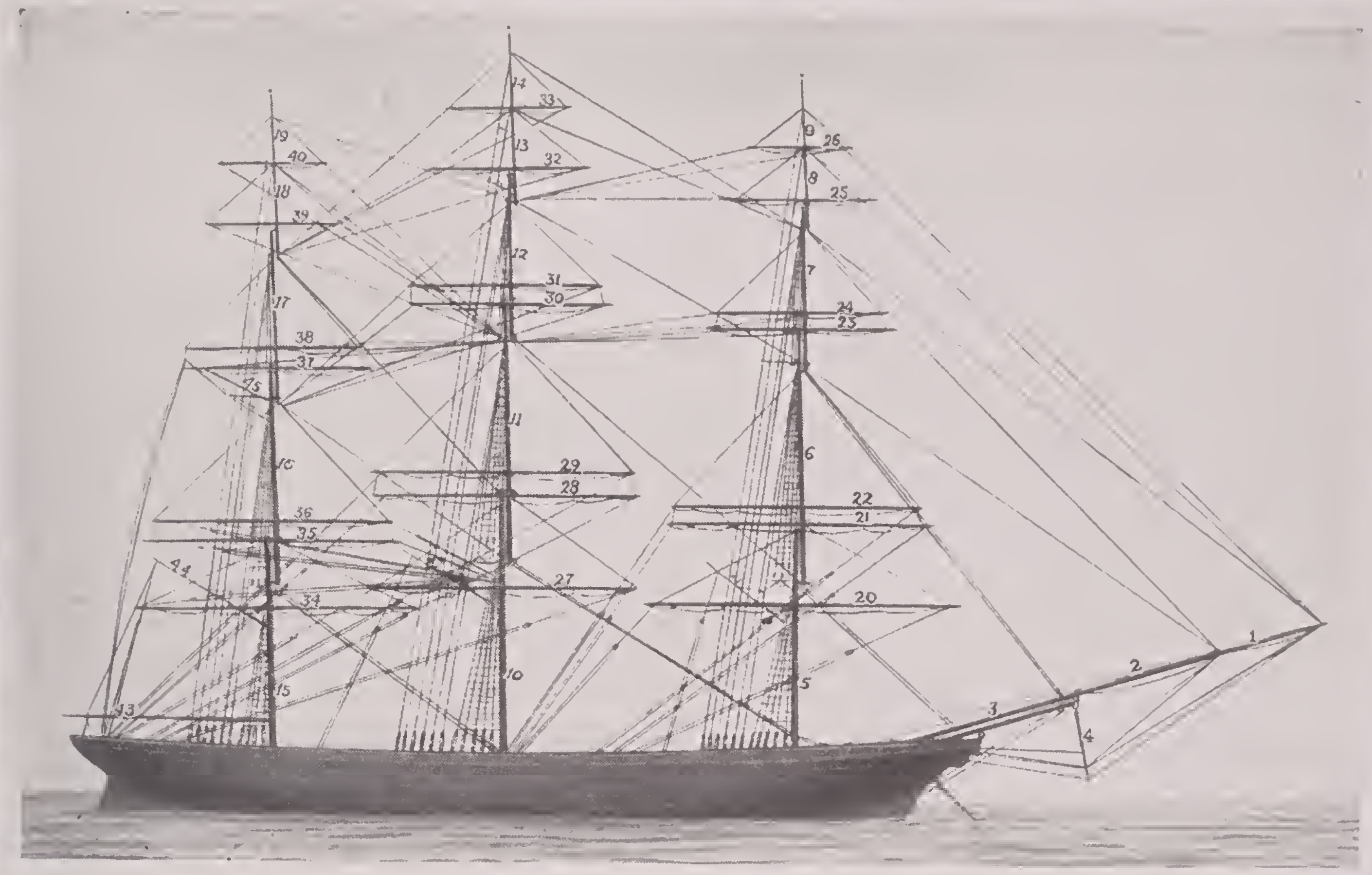
AN EARLY LEVIATHAN, THE 'GREAT EASTERN'

The *Great Eastern* (originally called the *Leviathan*), a paddle and screw steamship launched in 1858, was for many years the largest ship in the world. It was nearly 700 feet long, 83 feet broad, and 60 feet deep. It was far in advance of its time, and was never a financial success.

As England grew to be the "mistress of the seas," sails, used more skilfully by English seamen than by their predecessors, became the only motive power for merchant and naval vessels alike. Craft that would be recognized by a modern sailor began to appear on the seas—full-rigged ships in the modern technical sense, brigs, barks, etc. High-water mark in the development of the sailing vessel for beauty and speed was attained, however, not by British vessels, but by the famous "Yankee clippers" of the 1840's and '50's. Previously the hulls of merchant ships had been constructed for capacity rather than speed. The loss and ruin sometimes incurred in the East India and China trade through market changes or deterioration of cargoes on long voyages stimulated the construction of a new type—a long slender vessel, at first small, but later from 135 to over 300 feet long—with fine lines, sharp bows, towering masts, and an immense spread of square-rigged sails, which slid or "clipped" instead of pounding through the water by main force. This was a distinct type from the long, low, rakish, and comparatively small craft—60 to 125 feet long—with full round bows and sails, sometimes square and sometimes schooner-rigged, which had won renown in the War of 1812 as the Chesapeake or Baltimore clipper. The true Yankee clipper rejoiced national pride by making speed records seldom equaled before or since by any sailing vessel; 300 miles a day was not exceptional. During the brief heyday of this craft, the world's carrying trade seemed destined to fall into American hands despite all that alarmed competitors could do. But the fleet beautiful Yankee clipper was merely the romantic closing episode in the long and glorious chapter of the supremacy of sails and wood upon the seas, for the day when steel and steam would rule the oceans was even then dawning.

The United States at present has the largest sailing tonnage (though not the largest number of sailing vessels) of any country in the world, but American sailing vessels are practically all employed in fisheries, in the coasting trade, or on inland waters. All over the world there has been a steady decline in the number of square-rigged sailing vessels as compared with the more economically worked fore-and-aft rigged vessels. The schooner (an American invention)

SOME FAMOUS STYLES IN SAILING VESSELS



A FULL-RIGGED SHIP

Sailing ships may be divided into three distinct classes—the square-rigged, the fore-and-aft rigged, and the mixed-rigged. The square-rig, which is illustrated above, consists of sails hung from horizontal yards, which are slung at their middle points to the mast. When the ship is sailing before the wind, these sails are spread at right angles or "square" to the keel. A full-rigged ship—a "ship" in the technical sense—has three masts, all square-rigged, called from bow to stern the foremast, the mainmast, and the mizzenmast. A "brig" has only two masts, the fore and main.

A full-rigged ship may carry five or more sails, one above the other, on each mast. The same names are applied to the corresponding sails and spars on each mast, except that the name of the mast is prefixed. In describing the rigging of a ship we shall refer to the foremast, but in every case in which a corresponding spar is used on the main or mizzenmast the number of the corresponding spar will be given, so that you can locate, for example, the fore topmast (6), main topmast (11), and mizzen topmast (16).

Each mast comprises five separate parts or masts. The bottom one is called the foremast (5), mainmast (10), or mizzenmast (15) as the case may be, and the upper ones, in order, are the topmast (6, 11, 16), the topgallant mast (7, 12, 17), the royal mast (8, 13, 18), and the skysail mast (9, 14, 19).

Square-rigged ships usually carry a set of triangular sails called jibs, hung on stays strung from the foremast to a jibboom (2), and to a flying jibboom (1), which project from the bow. Below the jib is a vertical stay called the martingale (4). These jibs serve to "keep the nose up," that is, to keep the sails on the mast from tending to tilt the vessel forward, and thereby drive the bows too heavily into the seas. The bowsprit (3) is the timber which supports the jibboom.

The bottom yards or arms, extending horizontally from the masts are the foreyard (20), the mainyard (27), and the cross jackyard (34). Next above these are the lower topsail yards (21, 28, 35), then the upper topsail yards (22, 29, 36), the lower topgallant yards (23, 30, 37), the upper topgallant yards (24, 31, 38), and the royal yards (25, 32, 39). The topmost yards are the skysail (26, 33, 40). On the mizzenmast are a number of special arms—the spanker boom (43), the spanker gaff (44), and the monkey gaff (46).

The fore-and-aft rig consists of one large sail to the mast. This may be spread between a horizontal boom at the bottom and a shorter gaff above. The gaff is a spar fastened to the mast by a collar; it points midway between horizontal and vertical, and can be raised and lowered by halyards. The sail swings to one side or the other of the mast, or directly back of it ("aft"). Such sails can be handled from the deck, so that a large vessel may be manned by comparatively few men.

The single-masted "fore-and-after," with a gaff mainsail and a jib, is called a "sloop"; with two or more masts, and a jib, a "schooner." A sloop with a smaller second mast is called a "yawl."

Vessels with mixed rigs, the third class, carry both square and fore-and-aft rigging. A two-master with square rigging on the foremast, and fore-and-aft rigging on the main, is a "brigantine." A threemaster with square rigging on the fore, and fore-and-aft rigging on the other two, is a "barkantine"; if only the mizzenmast is rigged fore-and-aft, it is a "bark" or "barque."

is the typical American sailing craft today. A seven-masted steel schooner built some years ago was nearly 400 feet long, had a capacity of 7,500 tons, and carried a sail spread of nearly an acre—about the same as that of the *Great Republic,* the largest of the clippers, which was about 100 feet shorter and had about half the carrying capacity. A fishing craft or carrier of heavy freights—coal, ore, lumber, etc.—the modern sailing vessel is merely a sturdy drudge with little romantic or esthetic appeal.

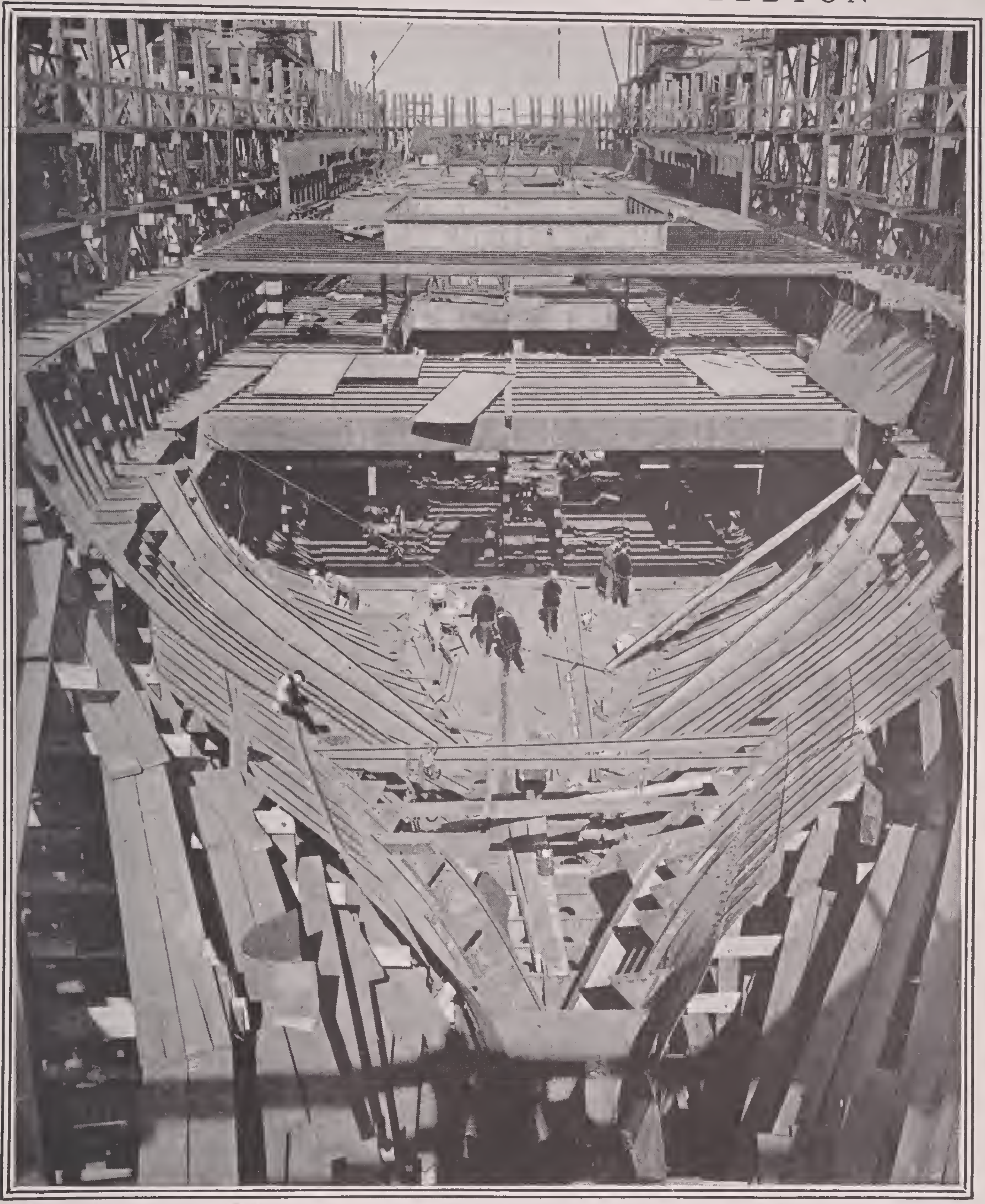
THE MIRACLE CITY, HOG ISLAND SHIPYARD

The Hog Island shipyard at the height of its activities was called the "eighth wonder of the world." From a mud swamp, it was transformed in less than a year into the world's largest shipyard; it boasted one ship launched every 3½ working days, and a total dead weight tonnage of over 600,000 tons launched in a year.

In closing decades of the 18th century many experiments were made with steam propulsion of boats. Twelve years after Fulton's *Clermont* made its first voyage on the Hudson (*see* Fulton, Robert), the first vessel fitted with steam power crossed the Atlantic. This was the American built *Savannah* which in 1819 ran from Savannah to Liverpool in 25 days, most of the time, however, under sail. The engines of those days consumed about four times as much fuel as modern engines for every horse-power produced, so the problem of a transatlantic steam passage was a fuel problem. The *Savannah's* voyage and the one or two transatlantic passages made by steam vessels in following years made such slight impression that in 1835 "sober sensible people" hooted at the suggestion of a steamship line between Great Britain and North America; one might as well talk of running a steamship line to the moon, they said. And a boat from the moon could scarcely have created a greater sensation in 1838 than the arrival in New York harbor of the *Sirius* from London which had made the whole run from Cork in 17 days entirely under steam power. A few days later the *Great Western,* the first steamship built for transatlantic service, arrived from Bristol. And now the transatlantic steam liner was an accomplished fact, and before long the "seven seas" were netted with steamship lines. The only one of the early transatlantic lines to survive, however, was the Cunard line, founded in 1839. The White Star, originally a sailing line, sent its first steamship across the ocean in 1870.

The fastest sailing vessels as a rule made the voyage from Europe to America in several weeks. One sailing vessel made the passage from Liverpool to Baltimore in 14 days 9 hours. Less than a hundred years from the time of the *Savannah's* voyage the fastest steamships were to make it in four and a half days. The first transatlantic steamships, to be sure, were not infrequently beaten in races with the swift sailing packets. Even today, the hourly speed at which it is found most profitable to run ordinary freight steamships—9 to 12 nautical miles—is no greater than that of the clipper ships—12 to 15 miles—and far below the record clipper speed—21 miles. It is only our great luxurious passenger liners, which disdain freight almost altogether, that make speeds of 25, 26, and 27 nautical miles an hour. Yet from the first, commerce tended inevitably to flow in the channels provided by the new steamship lines; and today the London merchant gets tea from China in five weeks, whereas the fastest of the tea-clippers took three months. Steamship voyages are enormously speedier than sailing voyages, even though there may be no such excessive difference in the speed per hour. The overwhelming advantage of steam to commerce is its comparative freedom from delay by adverse weather conditions and its ability to take

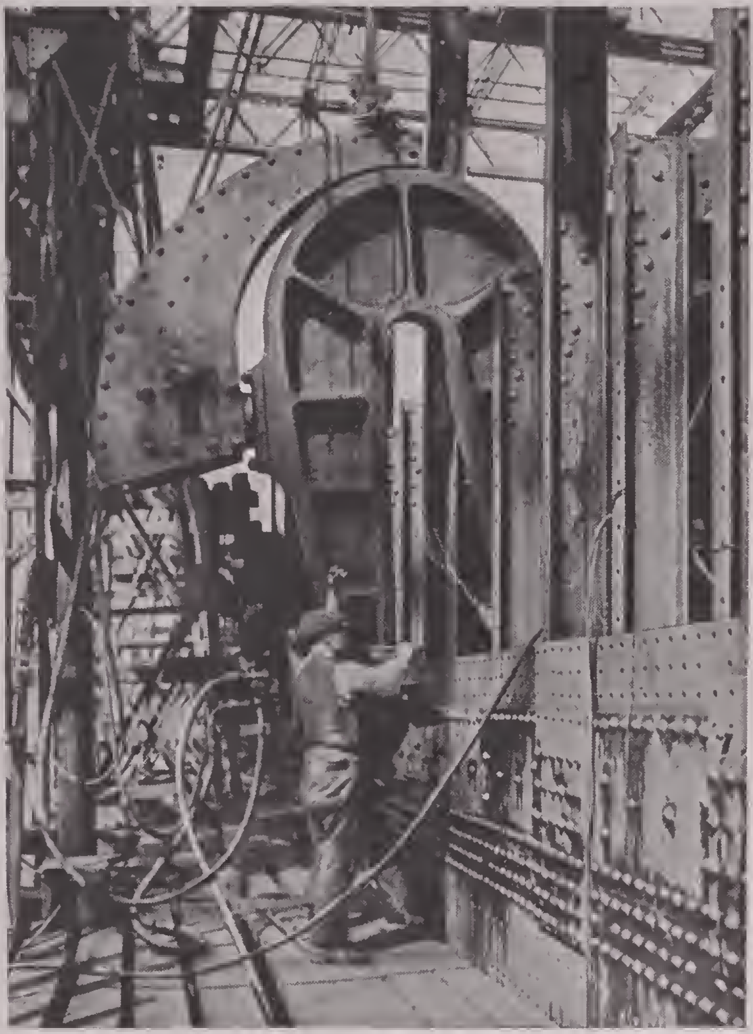
BUILDING A SHIP—THE SKELETON



A web of staging, built in movable sections of strong timbers and planks capable of bearing considerable weight, supports the hull until it is ready for launching. After the carpenters have lined up the keel blocks, an erecting gang lays the keel and begins the work of putting in place the steel framework, floors, and steel plating for the outside of the hull. Every part is so marked as to indicate exactly where it is to go. The erecting gang may hang each plate by a bolt or two, leaving it to be adjusted to its exact proper place by a plate-setting gang, which puts in enough bolts to hold it, after which it is solidly riveted by a gang of bolters. As the inner construction proceeds, stagings and supports are built inside the hull and bolted solidly to the frame of the ship. While the principal structural work on the hull is being carried forward, other groups of workmen begin painting the ship inside and out. The entire bottom of the ship and of many of the ballast tanks are covered with a layer of portland cement from an inch to an inch and a half deep. Before the ship is launched its tanks are tested by filling them with water to the height of the load line, and the joints of the decks and bulkheads are tested by a jet of water from a hose at about 30 pounds' pressure. In this case, however, all these processes except the painting come later, for here the construction is just far enough advanced so that the outlines of the ship are becoming apparent. You can see three decks and the framing rising to support a fourth, the cargo hatches, and the first of the plating being put into place.

advantage of the shortest routes. A sailing vessel bound from New York to Rio de Janeiro would first sail east almost across the Atlantic to near the Azores, and then turn south, taking advantage of the trade winds to reach Rio; a steamship would be able to take the most direct route.

RIVETING THE STEEL SKIN



The rivets which hold the steel plates together are driven while red hot. Over 650,000 rivets are needed in the construction of an average 10,000-ton ship; it is said that "the history of steel rivets is the history of the steel ship business."

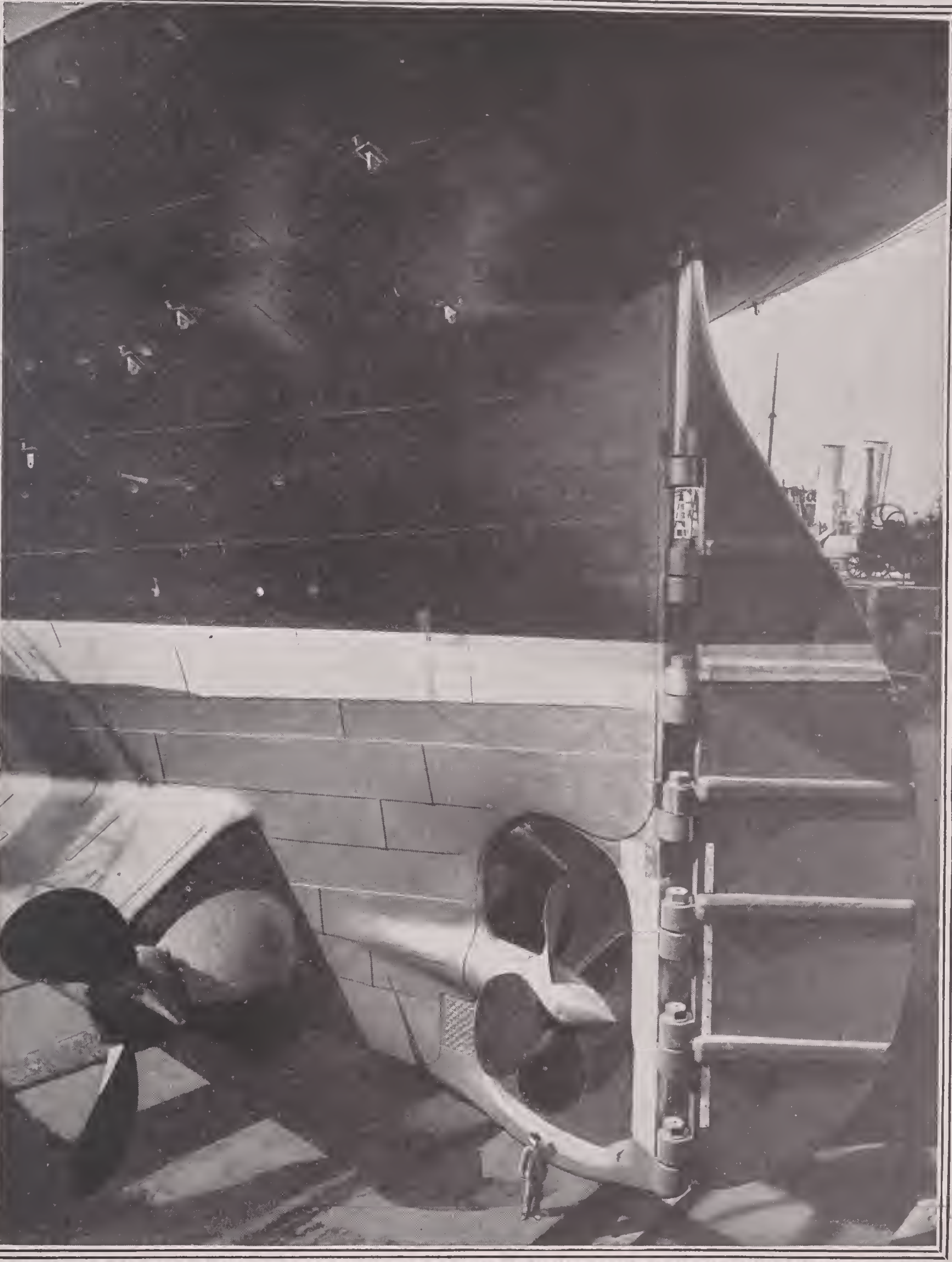
Almost parallel with the rise of steam power, an equally important revolution in construction was under way. The early steamships were built of wood, but experiments in the use of iron for the hulls of vessels had been made even before the end of the 18th century. Between 1845 and 1880 iron came more and more into general use, gradually superseding wood for large vessels. The Cunard line was still building wooden ships when in 1850 the Inman line of iron screw steamships was inaugurated. The first steel steamboats were built in the 1850's for the exploration of African inland waters. Not until the '70's was steel used for ocean-going vessels, but from 1880 on, steel gradually replaced iron, until today "steamship" practically means "steel ship."

"Will iron float?" jeered passersby at the builder of the first iron vessel. "Pitch your tea cans into the canal and see," he replied. Actually, an iron or steel vessel is not only stronger but lighter than a wooden vessel of the same size, though wood resists a crushing force better than metal, and wooden ships are therefore favored for polar exploration and voyages in polar seas where icebergs and floes are to be feared. Some of the earliest iron vessels built floated scatheless off after buffeting on shoals in storms in which wooden ships quickly went to pieces. Iron construction, it has been estimated, saves 30 to 40 per cent over the weight of wood, and steel saves 15 per cent over the weight of iron. This means increased carrying capacity and lower freight rates. Moreover, steel can be more securely riveted than wood; a large steel ship shows less tendency to sag in the middle or to droop at the ends than a wooden one of the same size. Welding instead of riveting transforms it practically into a piece of solid steel. Therefore the only limit on the size of modern steel ships is virtually the size of the harbors and docks which receive them.

The Decline of American Shipping

Steam and steel ended the fleeting golden age of the American merchant marine. There were other contributory causes for the decay of American shipping, including the disasters it had suffered during the Civil War, the attraction of American capital and labor into new and more profitable fields as the western states were opened up, the opening of the Suez canal, which gave Europe a shorter and cheaper route to the East, and the unequal conditions under which American ships competed with subsidized foreign shipping. But the decisive factor was the advanced state of the British steel industry, which was ready at the time of the revolution in shipbuilding to employ Bessemer's discovery (*see* Iron and Steel) in the construction of ships, while the American steel industry was several decades behind.

The *Clermont* and all later steamboats for many years were propelled by paddle wheels, which are well adapted for the propulsion of light draft boats over smooth shallow waters (some of the early river captains boasted that their boats could run "on a heavy dew"), but are less efficient than the screw propeller in deep waters. An American inventor, Col. John Stevens, had worked out the principles of screw propulsion of steam vessels even before Fulton's memorable first voyage on the Hudson, but American tools and machinists were not then equal to reproducing Stevens' beautiful models. So the first ocean screw steamships were built in England between 1836 and 1839 by an Englishman, F. P. Smith, and a Swede, Capt. John Ericsson, later of *Monitor* fame (*see* Ericsson, John). Paddle wheels would have offered an inviting target to an enemy in war; the advantage of the screw propeller, placed below the water line, quickly appealed to American and British naval authorities. Merchant vessels generally were slower to discard the paddle wheel, chiefly because the marine engines then in use could not economically drive screw propellers. About four years after "Inman's iron screws" were placed in service, the compound engine (*see* Steam Engine)



The tiny figure of the man at the bottom of the picture will help you to realize how enormous are the rudder and propellers of a big modern ocean liner. The rudder alone weighs 70 tons—as much as a medium-sized locomotive. As the ship plows its massive way through the waves, the helmsman turns a small wheel high up in the wheel-house; immediately powerful machinery obeys the command and twists the rudder post, swinging the great rudder on its hinges with the smoothness and accuracy of a watch. The three giant propellers, projecting at the ends of their powerful steel shafts, likewise obey the touch of the engineer's hand, threshing the water with their twisted blades to drive the vessel forward or to check it suddenly in its headlong course.

was adapted to marine use, and the screw propeller quickly became the recognized mode of propulsion for ocean vessels. Twin screws, lessening the danger of accident, came a little later; three and even four screws are used on some steamships today. Later yet came the triple-expansion engine; and this was the last work in marine engineering until the application of the turbine to steamships.

The first turbine steamboat, the *Turbinia*, demonstrated in 1897 the sensational speed capabilities in this mode of propulsion (*see* Turbine). The *Mauretania* today makes a speed of 26 to over 27 nautical miles (30 to over 31 land miles) an hour by means of six great turbines, the blades of which, running at full speed, have a velocity at the outer tip of nearly 10,000 feet or nearly two miles a second. Speed rivalry some time ago led to some disregard of safety; but there is little tendency at present to attempt to outdo speed records.

The Great Devourers of Coal

Speed on the ocean is a costly luxury. The coal burned in one day by a large modern liner, it is said, would drive a tramp steamer of 6,000 tons freight carrying capacity back and forth between New York and Liverpool three or four times, running at a speed of nine or ten miles an hour. It takes about 6,600 tons—about 22 trainloads—of coal to carry the liner across; and this mountain of fuel, with the machinery in which it is burned, is so bulky that the monster vessel has room for only about 1,500 tons of freight. The cost and bulk of the fuel required for high speed forbid the freight steamship to exceed the limits dictated by freight rates, while the less expensive passenger liners make no attempt at speed records. Thus one steamer consumes 316 tons of coal a day to make a speed of 19 knots; another nearly two and a half times as large consumes only 260 tons a day for a speed of 16½ knots.

Great savings in labor and space have been made by equipping steamships to burn oil, the fuel destined, it is said, to supplant coal in ocean navigation. Formerly, 140 men needed three or four days to coal the *Olympic* for a voyage. Now that ship is equipped as an oil-burner, saving 1,000 tons of cargo space, and seven men pipe the oil into the tanks in six hours. A hundred and fifty firemen, who formerly sweltered in an inferno while they slaved to fill the greedy maws of the red-hot furnaces, are released; no such toil is needed in tending the oil furnaces. The entire annual money saving is estimated at nearly $1,300,000. To war vessels the great advantage of oil fuel is that it enormously extends the length of the voyage which they may take away from their base of fuel supplies and makes it possible to take on fuel at sea through pipe lines from tank ships (*see* Navy).

Great "floating palaces" like the *Olympic* and the *Mauretania* may have from 7 to 10 decks, electric elevators, open-air gymnasiums, swimming pools, libraries, music rooms, lounges or drawing rooms, smoking rooms, and private suites of rooms like miniature flats, with electric heat, silver fittings, silk hangings, etc.—all the luxurious magnificence, in short, of the most expensive metropolitan hotels. The majority of passenger ships, however, are of an intermediate type, which provides every comfort for the passenger without costly splendor.

In the shipyards that dotted the North Atlantic coast until after the Civil War, wooden ships were built at first—during the colonial period—on the "cut and try" plan, after the pattern of some former ship. Gradually American shipbuilders mastered the use of drawing instruments and the theory of vessel designing, and soon it was the original design of the ships constructed in the American shipyards, even more than the excellence of American live oak, white oak, yellow pine, and spruce, which gave preëminence to American vessels.

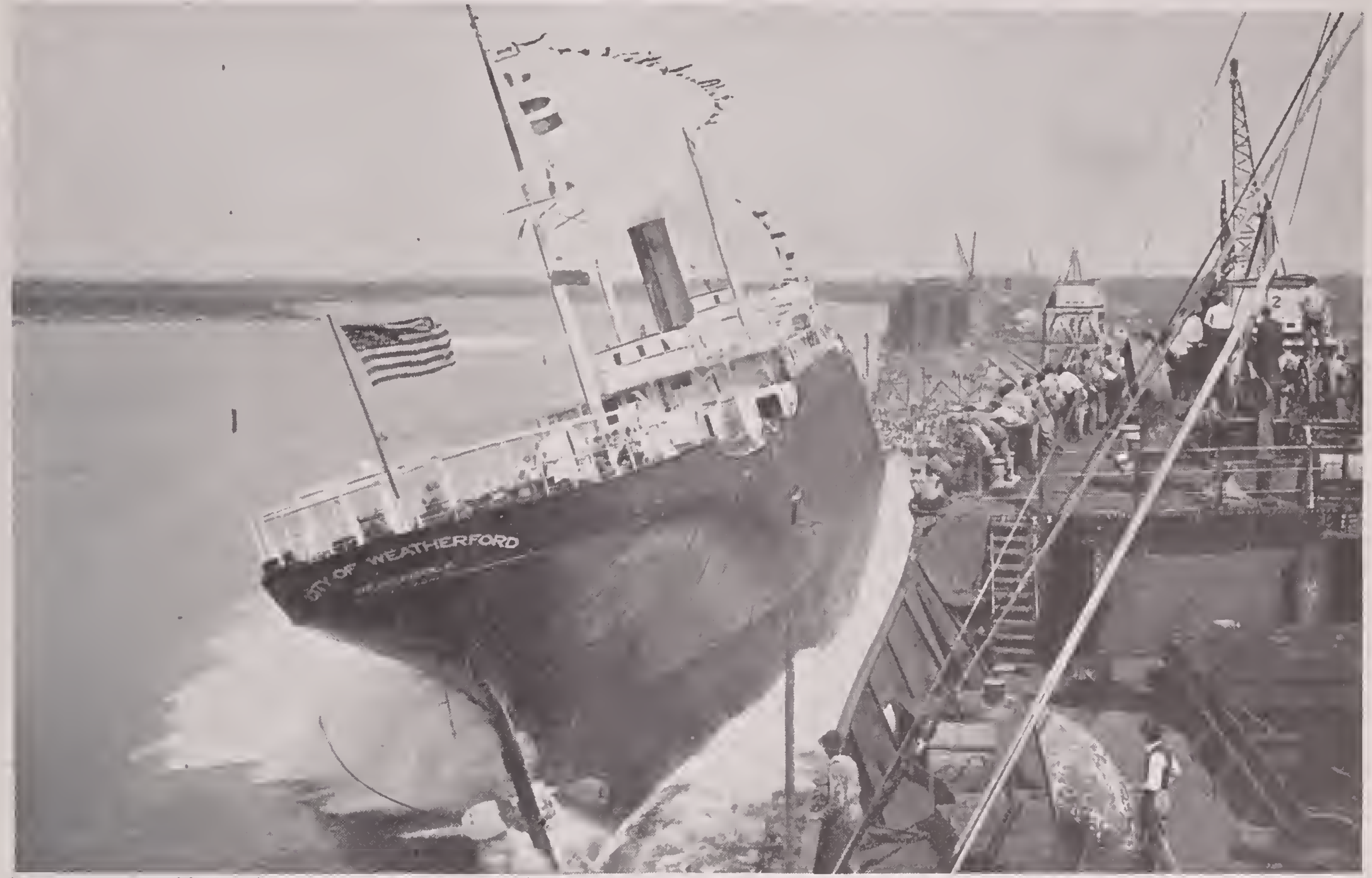
It was altogether a native industry. The boys that loitered in the shipyards after school probably looked forward to sailing in just such a ship as that now growing to the merry tune of clattering mallets and scraping saws wielded by workmen who were friends and neighbors—perhaps themselves retired sailors. The owner's daughter might pose as a model for the figurehead shaped by the wood-cutter in the corner of the yard. Most of the workmen were artists in their way, taking pride in the work of their hands and competing jealously for the more difficult tasks. Until about 1830 any skilled shipyard mechanic performed any and all work incident to the construction of a ship. Thus the industry was itself a school for all engaged in it.

Modern Shipbuilding

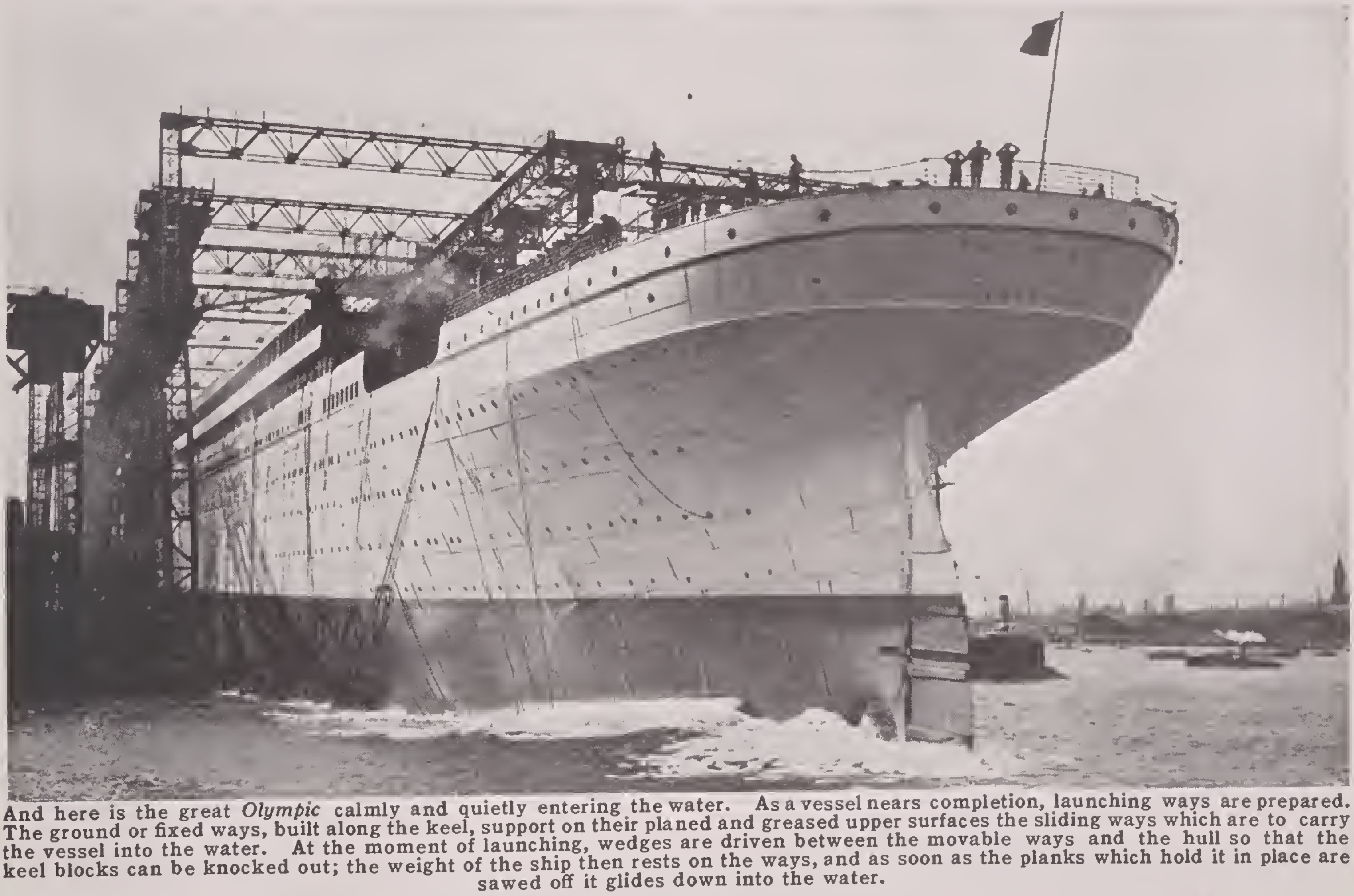
The difference between that time and today can best be appreciated by a glance at a modern shipyard. Let us visit the greatest shipyard ever known, the huge Hog Island plant, at the height of its activities during the World War when the cry was ever for ships and more ships to bridge the ocean and outstrip the destruction of the German submarine. Hog Island, near Philadelphia, was a mud swamp of over 900 acres, which in less than a year from September 1917 was transformed into the world's largest shipyard, with a modern city for housing employees and 75 miles of railroad connecting all parts of the plant with the fifty shipways. This one yard had a record of one ship launched every three and a half days, a total of over 600,000 tons of shipping launched in a year.

As we approach, our ears are assailed by the gigantic clamor of crashing metal, from which presently we are able to pick out individual notes—roaring foundries, clanging engines, whirring dynamos, and thundering hydraulic hammers. At the water's edge, the cranes and scaffolding of the ways form a rough pattern of upstanding colossal lace-work. Underfoot instead of the springy carpet of spicy chips and shavings covering the ground in the wooden shipyard, we find a strange litter of monstrous metal parts among which we pick our way—steel plates and bars,

THE GREAT MOMENT THAT TESTS THE SHIP



Here we see a ship leaving the "ways" in the shipyard at Pensacola, Fla., while an excited crowd leans over the railings above to wish the new vessel good luck. Ships may be launched sideways, as here, or stern foremost, depending upon the convenience of the shipyard.



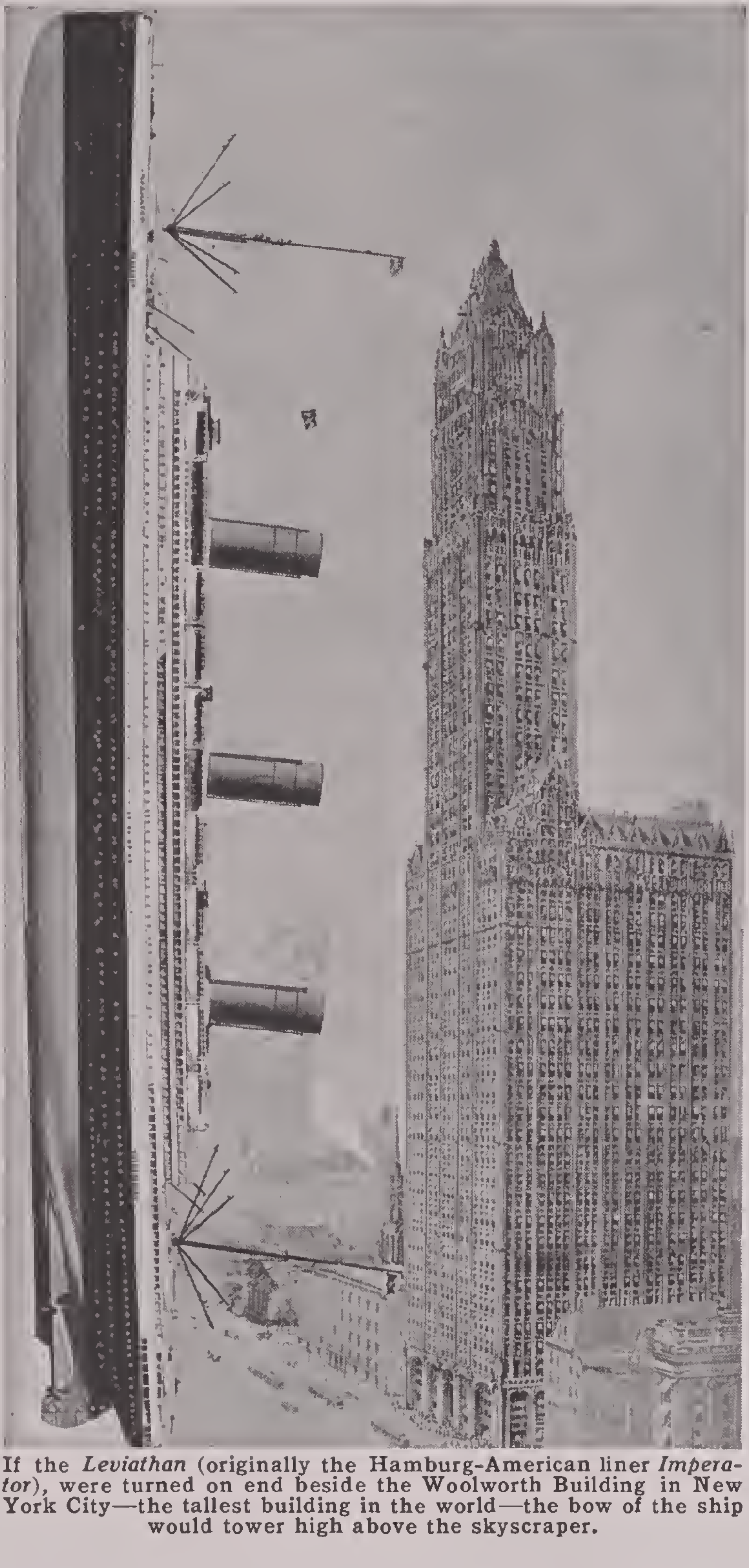
And here is the great *Olympic* calmly and quietly entering the water. As a vessel nears completion, launching ways are prepared. The ground or fixed ways, built along the keel, support on their planed and greased upper surfaces the sliding ways which are to carry the vessel into the water. At the moment of launching, wedges are driven between the movable ways and the hull so that the keel blocks can be knocked out; the weight of the ship then rests on the ways, and as soon as the planks which hold it in place are sawed off it glides down into the water.

iron chains, etc. As various and, to many of us, as unfamiliar are the tasks of many of the men we see at work in the open air or in the vast interiors of the sheds and mills—furnacemen, rollers and flangers, punchers, shearers, acetylene cutters, electric welders, machine riveters, chippers, calkers, yard riggers, besides clerks, draftsmen, electricians, carpenters, machinists, painters, and unskilled laborers, employed on various specialized tasks. When the whistle blows and the 5,000 and more employees of the yard surge forth for the mid-day meal, we see as motley a mingling of races and nationalities—not only Americans, Englishmen, and Irishmen, but Scandinavians, Greeks, Portuguese, Italians, Slavs, and negroes. Most of them know as little about the ships on which they are engaged today as they did about the bridges, the sky-scrapers, or the roads on which they were employed a few days or weeks ago.

In normal times, such data as tonnage requirements, speed desired, and depth of water in the harbors which the ship is intended to frequent are given to the designer of the ship to be constructed. He first calculates the displacement and then determines length, beam, and depth. In accordance with these data he prepares his design, which is turned over to structural and engineering draftsmen to work out in detail. During the war standardized designs were largely used, instead of having a marine architect work out an individual design for each vessel. This saved time, just as it saves time for a dressmaker or tailor to use a standardized design or pattern for clothes instead of designing each individual garment separately.

The drawings or blue prints of the design, made to scale, are re-drawn full size on the floor of the mold loft. This room (usually the top floor of the largest building in the yard and 100 feet wide and several hundred feet long—large enough to take in the full-size plan of a liner or battleship) has a specially prepared floor, as smooth as a school blackboard. From the drawings on the mold-loft floor, full-size wooden or paper patterns, called "templates," are constructed for each piece of steel to enter into the vessel. On each template every rivet hole, bend, flange, or angle line is accurately indicated. The ship-fitter transfers these marks to the steel plate, which is then taken to the steel mill to be cut, bent, punched, and shaped in accordance with the indications of the template.

LAND AND SEA GIANTS



If the *Leviathan* (originally the Hamburg-American liner *Imperator*), were turned on end beside the Woolworth Building in New York City—the tallest building in the world—the bow of the ship would tower high above the skyscraper.

Even this labor was to a great extent eliminated in the construction of fabricated ships such as those built at Hog Island. They represented the supreme effort to speed up steel ship construction. In the rigorously simple design of the fabricated ship—mainly tankers and certain kinds of freighters—every unnecessary curve—every non-essential of whatever kind—was suppressed, and the parts, so far as possible, were turned out in quantity, shaped, punched, and prepared for use, instead of being prepared in accordance with specifications as needed, just as the parts of ready-made garments are cut and prepared by thousands. The fabricated ship, in fact, was a "ready-made" as contrasted with a "made-to-order" ship, and this enabled the Hog Island plant to turn out, as from a factory, the largest ship tonnage ever built within a given time.

The actual construction of the ship begins with the laying of the keel. First, the berth for the ship is prepared at the water's edge. Keel blocks—short heavy timbers with the upper surface shaped to the

A STREET ON A FLOATING CITY

If you could pick up a city street and set it down on the decks of the 'Aquitania', the traffic could go on unhindered and the great liner's smokestacks would project well above many an office building.

keel line—are set up with a very slight incline toward the water. On this is laid the keel, composed of a number of bars or thick plates of heavy steel, each perhaps 40 or 50 feet long, riveted together to make the desired length and thickness. While the frames are being built up from the keel and the plates are being riveted in place, temporary staging is erected inside and outside the hull as needed.

The steel plates which form the shell of the ship are laid, like giant fish scales, 20 to 40 feet long, in overlapping horizontal rows called "strakes." They provide the main strength of the hull, being merely supplemented by the frames. The seams of wooden ships are calked with oakum and pitch; steel ships are calked by driving down the overlapping edges of the upper plates so that they "bite" the plates below. In some of the latest vessels they are electrically welded instead of riveted, producing practically a solid metal shell.

Large steamships are built today with double bottoms, which lessen danger in case of accident. The space between the bottoms, in which a man can almost stand upright at the center of the hull, is used for ballast or for storing fresh water for the boilers or oil for the engines. Still more important for safety are the bulkheads or crosswise and lengthwise vertical partitions which divide the hull into watertight compartments. The more numerous these compartments, provided they are really watertight, the less the danger of sinking. The main lengthwise bulkhead is of special value also in counteracting the tendency of the ship to sag in the middle or to "hog," as drooping at the ends is called. Of particular importance is the "collision bulkhead" in the bow, which is built especially strong to withstand ramming and to confine the damage to that part of the ship if the bow should be stove in. The doors in the bulkheads are watertight and provided with closing apparatus electrically controlled from several central stations, so that any or all can be closed in a second by pushing a button.

The hull is usually launched as soon as it will float; construction and fitting are finished in the water. The launching must be as carefully planned as the construction, for irretrievable injury has occurred from accidents at launchings. A vessel is usually launched stern foremost; occasionally, where water space is narrow, side foremost.

Even standardization and fabrication of steel ships did not alone completely meet the need for speed in shipbuilding during the war. The wooden shipbuilding industry was revived. New materials were pressed into service. Ships were built, like bridges, reservoirs, and large buildings, of reinforced concrete; that is, concrete poured into a mold around a steel frame. The seaworthiness of such a craft was demonstrated by the 5,000-ton concrete freighter *Faith* launched at San Francisco in 1918. Such a ship, it is said, cost about a fifth as much as a steel freighter of the same size, and could be built in about half or a third the time. The concrete ship division of the Federal Shipping Board developed a concrete which is one-fifth lighter than wood and therefore floats on water. The porous quality of concrete was originally its main drawback as a ship material, but the division produced a protective waterproof coating which was expected to make concrete ships as durable as wood, if not more so, in view of the fact that the marine wood-borer cannot attack concrete.

Varieties of Modern Ships

Varied demands have produced an almost infinite variety of ship types. Omitting war vessels (*see* Navy; Submarine), ships may be roughly classed according to use as: (1) luxurious ships almost exclusively for passenger service; (2) ships carrying both passengers and freight; (3) freight ships.

The first class includes the largest as well as the most luxurious and the swiftest vessels built. This is a matter of commercial necessity; the immense cost of high speed can be met only by large steamers devoted to the most expensive passenger service. The Cunarder *Mauretania* is about a city block and a half long; one of its funnels, turned down, could take in two lines of subway cars side by side. Yet the *Mauretania*, with its 32,000 gross tons and its length of 790 feet, does not bulk large by the side of its big sister the *Aquitania* (47,000 gross tons; length 901 feet), of the largest White Star liners, the *Olympic* (over 46,000 gross tons; length about 880 feet) and the *Britannic* (50,000 gross tons; length 900 feet); while it is fairly dwarfed by the monsters built for the Hamburg-American line, the *Imperator* (51,000 gross tons; length 909 feet), the *Vaterland* (54,000 gross tons; length 950 feet), and the *Bismarck* (about 58,000 gross tons; length 955 feet). The *Vaterland* was one of the German vessels interned by the United States at the outbreak of the World War; it was seized when the United States entered the war and operated as the transport *Leviathan*. The *Imperator* was turned over to the British at the armistice in 1918 and was put into the service of the Cunard line, and the *Bismarck*, which had not yet been completed, was given to the White Star line, also a British company.

Of the vessels in the second class, some are devoted about equally to freight and passenger traffic, while others derive most of their revenue from a single branch, carrying freight or passengers as a side line. Transatlantic emigrant vessels are always arranged to carry as much cargo as possible. The holds of some of these vessels carrying perishable produce, such as the ships bringing meat from Argentina and New Zealand and fruit from the tropics, are fitted up as great refrigerators. One such vessel of 7,500 tons carries over 500 passengers in comfortable quarters; its insulated cargo-holds are chilled by 20 miles of brine pipes.

In the third class are included freight liners, which keep to a definite course and schedule like passenger liners; tramps, which ply all over the world, wherever they can pick up a cargo (*see* Commerce), and vessels built and operated to take care of certain classes of traffic, like the oil tank steamers, the iron ore and grain steamers of the Great Lakes, and the lake and ocean steam colliers or coal-ships. Some of the hugest and most wonderful freight-handling devices in the world are used in connection with these Great Lakes freighters (*see* Great Lakes). Built like great boxes, with flat bottoms and straight sides, and with pilot house and officers' quarters forward and crew's quarters and machinery aft, the vessels are unobstructed amidships. A boat 600 feet or more long will have about 12 great hatches, each nearly as wide as the craft, through which 12,000 tons of ore can be delivered by gravity chutes in two hours, and unloaded in eight or ten hours by huge clam-shell grabs, each lifting 5 to 15 tons at a time.

Then there are vessels for special uses, scarcely to be classified as either freighters or passenger ships. Such are dredgers, tugs, cable-laying ships, ice-breakers, surveying, salvage, and coastguard vessels, and train-carrying ferryboats. Of the last-named class, some have been built carrying four tracks, and capable of transporting two locomotives and 24 to 36 cars. Some train ferryboats operating on the Great Lakes and in similar situations have been built to operate also as ice-breakers.

Paddle Wheels and Screws

Again, since hull and engine must be adapted not only to use but to the waters where they are to operate, vessels may be classified as ocean-going, coastwise, lake, and river craft. Paddle wheels, by which a boat may be safely manoeuvred in limited space, are still preferred for river vessels; they are also much used for lake passenger boats. Double screws—not twin screws side by side but a screw at each end, permitting rapid reversal—have come into general use for ferry boats. The "whaleback" type of vessel, with its rounded deck over which waves can sweep without injury, has been used both on the Great Lakes and on the deep sea; as a lake cargo boat it has been superseded by the straight-sided barge type just described, because of the advantage in rapid unloading possessed by the latter.

WHY THEY ARE CALLED "FLOATING PALACES"

If some genie out of the 'Arabian Nights' suddenly whisked you into this great salon lined with plumy fronded palm trees and banked with flowers, could you guess yourself afloat in midocean? Such luxuries are typical of the great liners of today.

The absolute dependence of the civilized world on shipping was emphasized as never before during the World War. If the submarine campaign of the Central Powers had succeeded, Great Britain would have suffered actual starvation. As it was, the destruction of the merchant-shipping, which is such a large and unappreciated fact in everyone's daily life, meant some degree of privation or change of habits for people almost everywhere.

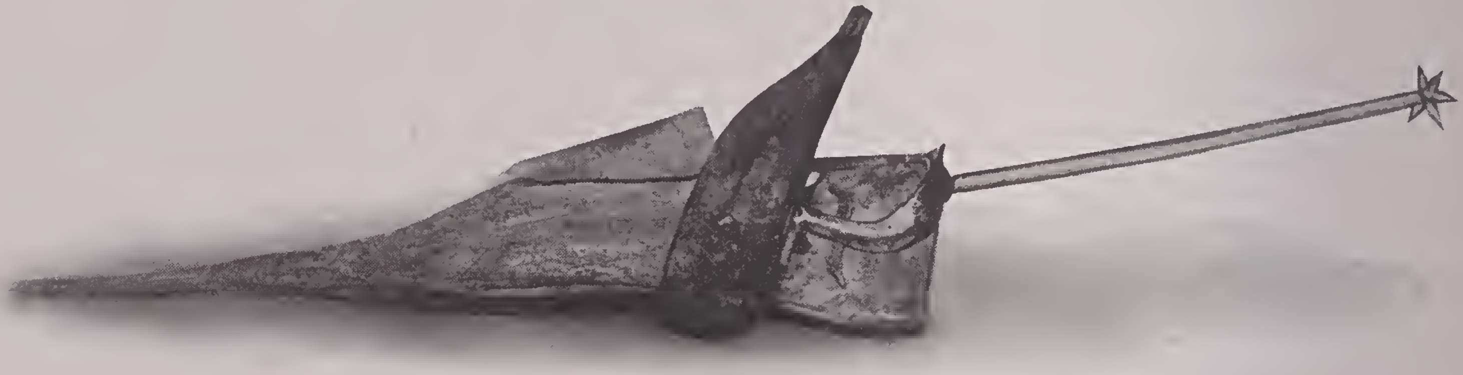
At the outbreak of the World War, Great Britain had between three and four times the tonnage of its nearest competitor, Germany. By counting in lake, river, coast, and deep-sea vessels, American tonnage came next after Germany, but nine-tenths of American ocean trade was carried by foreign vessels. The ruthless German submarine campaign, necessitating a "bridge of ships" to carry food and troops across the 3,000-mile ocean barrier between the United States and Europe, also effected a redistribution of tonnage to a considerable extent. At the end of the war Great Britain and the United States owned approximately 60 per cent of the world's tonnage. Of the 57,000,000 tons of shipping, 20,000,000 were British, 16,000,000 American, about 3,000,000 each French and Japanese, about 2,000,000 each Italian, Norwegian, and Dutch, and about 1,000,000 each Swedish and Spanish, the rest being distributed in smaller numbers among the many other nationalities of the world.

Feudal conditions were the invariable lot of the seaman on shipboard in the past. For the length of the voyage he was bound to the ship as the medieval serf was bound to the land. The ship's officers had over him, while on board, all power short of life and death; and punishment which indirectly resulted in death might be inflicted with impunity. No matter what the conditions and treatment on the ship, the sailor was subject to arrest and punishment for desertion if he left it in any harbor before the end of the voyage for which he had signed.

Such conditions are still the rule in the merchant marine of some nations. For American shipping they have been ended by the Seamen's Act of 1915, which abolishes arrest and imprisonment for desertion, prohibits flogging and all forms of corporal punishment, and regulates the payment, duties, treatment, and discharge of seamen. The act provides that no vessels of 100 tons and upwards, no matter what their nationality, may leave any port of the United States unless 75 per cent of the crew can understand the orders of the officers. The law requires that crews' quarters be large enough to provide 16 square feet of deck and 120 cubic feet of air for each individual, setting a good standard of sanitation and comfort. It provides also for medical attention, and for a good quality of food.

A ship's size and capacity are expressed in terms which are somewhat confusing unless certain distinctions are kept clearly in mind. "Displacement" or "displacement tonnage" is the weight of the water which the ship displaces—in other words, the weight of the ship itself. "Dead weight tonnage" is a ship's maximum carrying capacity, or the difference between its displacement light and its displacement loaded to its limit. Passenger and freight liners are seldom or never loaded to the limit of their capacity, and the term is not used in connection with them, but chiefly as a basis for charges on tramp steamers chartered to carry heavy commodities. "Gross tonnage" is defined as a ship's total measured cubic contents (in actual practice certain spaces are excluded from measurement in ascertaining gross tonnage) in "tons" of 100 cubic feet each. The official United States mercantile marine statistics are estimated on the basis of gross tonnage. "Net tonnage" is what remains of gross tonnage after deduction of space for fuel, machinery, crew's and officers' quarters, and other spaces devoted to purposes necessary for operation of the vessel. It is sometimes estimated that net tonnage averages about two-thirds of gross tonnage, but the ratio between gross and net tonnage varies widely in individual vessels; net tonnage may be very insignificant in an "ocean greyhound." The basis for tonnage dues is net tonnage, which is necessarily calculated according to arbitrary rules. There is a story of a man who, feeling injured at the tonnage dues on his vessel, built one in which the net tonnage, calculated according to the established rules, was a minus quantity, and who accordingly maintained that the harbor authorities owed him money whenever he left port.

FOOTWEAR—*From the* ANCIENT SANDAL *to the* MODERN SHOE



An Early 15th Century Shoe, with Stirrup and Spur

SHOES. Man is the "tenderfoot" among animals, so in very ancient times he began to fashion some sort of foot covering for protection from the burning sands and the stony ground. The animals could leave all this to nature, for they were provided either with soft cushions like those on the feet of the cat or with horny hoofs like those of the horse.

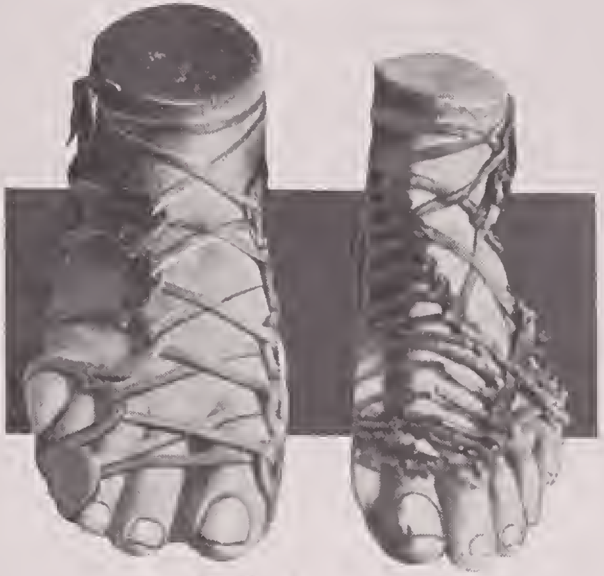
Man's earliest footwear was the sandal. Mats of woven grass, strips of hide, or flat pieces of wood to protect the soles of the feet were fastened by thongs over the foot, or sometimes brought up between the toes and bound around the ankle. In time, more material was added to cover the foot, either for decoration or for protection from the cold, and the sandal became the shoe. The Greeks and the Romans worked out a variety of decorative sandals, and some of the Roman styles approached the shoe form. In colder regions some of the first shoes were mere bags padded with grass and tied about the feet. Sometimes the skins of animals were made into moccasins or clumsy boots.

Sandals are still worn by a great many of the people of the Orient, and moccasins and soft skin boots are today made and worn by Indians and Eskimos. Another odd shoe still in use is the wooden shoe cut out of a solid piece of wood, worn by the peasant in Holland and other parts of Europe. The "clog" shoes worn by some of the millworkers of England and elsewhere have wooden or metal soles.

Modern footwear had its beginning in the Middle Ages. In the feudal days, the craftsmen who fashioned the footwear for the castle lords and ladies were very important personages. Substantial footwear was necessary in the cold northern climates, and persons who took part in the Crusades or went on long pilgrimages needed durable shoes. Furthermore the barons and knights paid a great deal of attention to their appearance, and to please them their craftsmen showed great individuality in working out a variety of slippers, shoes, and boots. Some were made with and some without heels. Some were adorned with great buckles. Fashions ran to ridiculous extremes. In the 13th and 14th centuries it was fashionable to wear long narrow-toed shoes; the higher the rank of the wearer, the longer the toes. When the toes grew to excessive lengths they were looped up and tied at the knees. Such shoes were cumbersome and awkward and were also very wasteful of material, so laws finally put an end to the style by threatening to fine and punish the wearers. High leather boots were fashioned as a protection to the leg after the knights ceased to wear full armor, and the height of the boot and the manner of its adornment came to indicate the importance of the wearer.

In all this rivalry of shape and fashion very little was done to make the shoe comfortable or to shape it to the foot. A boot or shoe would fit either foot, and it was not until about 1785 that in England a "right" and "left" last was used. More recently a great deal of study has been given the problem of securing the greatest foot comfort. This is especially true of army shoes, for it is very important that marching shoes for the soldiers be correctly built so as not to cramp or blister the feet on long marches. The later development in the industry has been chiefly in making shoes which are both comfortable and attractive, and in turning them out in such quantities that the price may be lowered.

SANDALED FEET OF THE ROMAN

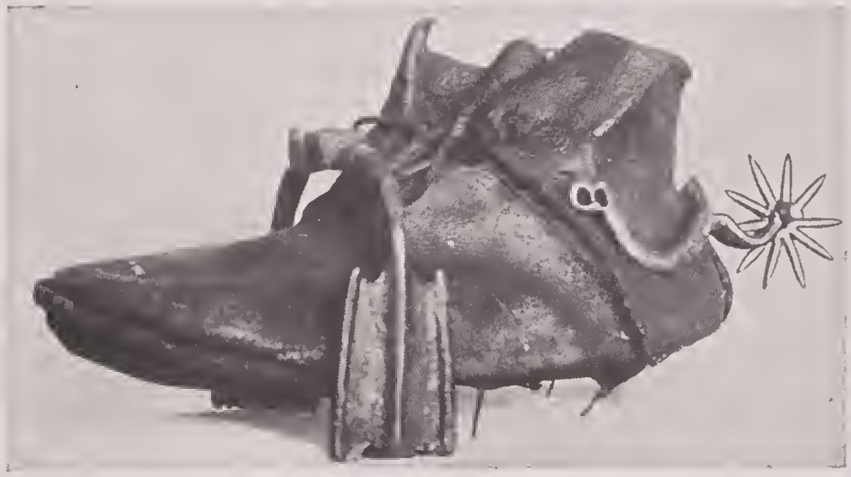


These two Roman sandals, that once trod London streets in the days when Rome ruled the world, were dug up in a deposit of peat in the Moorgate district of London.

Shoemaking as a business was introduced into America in 1629, when Thomas Beard, a shoemaker, arrived under contract to make shoes for the Pilgrim colony. In the pioneer days shoes were valued for their warmth and durability rather than for their style; but the trade soon developed so that the American shoes were said to compare favorably with those of the old country.

A young man desiring to learn the trade in those days would apprentice himself to a shoemaker. After he had learned the trade and had served his apprenticeship, he would become a journeyman. For a time he might go about from one family to another and from one town to another carrying his crude tools with him. Later he would settle down in business for himself as a shoemaker and cobbler or would become a hired workman in a large shoemaker's shop.

A RELIC OF THE MIDDLE AGES



Here is another shoe that walked the earth many centuries ago. It is a shoe of the Middle Ages and was found with the iron stirrup and spur in digging a ditch in the Newgate district of London.

At first one man did all the work on a pair of shoes. Later shoemakers with a reputation for making especially good shoes found that they could profitably employ others to do certain parts of the work for them, and one man would give all his time to cutting out and stitching uppers, another to putting on soles, and so on.

This was the beginning of the "factory system" in the shoe industry. After the invention of the sewing machine, machinery began to take the place of the expert hand work—a change which occurred also in many other industries with the coming of the factory system. In a modern shoe factory today there are as many as 170 distinct processes, taken care of by as many different machines. Many of these machines are very complicated and are so wonderfully adapted to their particular task that they seem to have more than human skill. Machinery makes a uniform product at a greatly increased rate of output. By expert hand work it was possible to turn out one pair of shoes a day for each man employed. With machinery it is now possible to make a pair of shoes in a quarter of an hour, and the output may be as large as ten shoes a day for each workman.

The United States led in the invention of machinery for the shoe industry, and that is why it is a leader in the industry today. Since 1870 its importation of shoes has been almost negligible, while the products of its shoe factories are sold in every country of the world. Over 300 million pairs of boots, shoes, and slippers are turned out in a single year.

The introduction of machinery began in the early half of the 19th century. The early shoemaker put the leather over a lapstone and pounded it with a hammer to make it smoother and more durable. A "roller" machine to roll and press the leather was one of the first machines to come into general use. In hand work the pattern for the parts of the shoe was laid out on the leather and the pieces were cut out with a sharp knife, one by one. Now dies are operated by machine, stamping out a number of pieces at one stroke and with absolutely true edges. The cloth linings also are cut on similar machines.

The invention of the sewing machine marked an epoch in the manufacture of shoes. Special machines were first adapted to sewing the seams in the linings and uppers, and in some factories there is even a specially built machine to sew each different seam. The final triumph of the sewing machine came when it was adapted to the difficult work of sewing the upper to the thick heavy sole.

When the specifications for an order of shoes are received in a modern factory, copies are made and sent to the different departments. Starting in the stock room, leather of the proper grade and quantity is selected. Uppers are cut from light cattle hides, calf skins, sheep skins, goat and kid skins, and horsehides, while the soles are made from cow hide. (For the making of leather *see* Leather.) The leather is put through a "rolling" machine and then through a "stripping" machine, which makes it of uniform thickness. Then it is sent to the cutting room, where the "clicking" machines stamp out the required number of parts by means of dies made up for this particular order. A "skiving" machine trims down the edges of the pieces to a neat beveled edge, and another machine folds over and pounds down any edge that will show on the outside of the shoe.

A SHOE OF SAXON DAYS

Shoes like this were worn by the ancient Saxons. They were simply pieces of leather shaped around the foot like the moccasin of the Indian.

The uppers with their linings are sent to the sewing room. Here they pass down the line of machines, each operator sewing one kind of seam, until the uppers are lined and ready for the sole. The metal eyelets are then stamped in for the laced shoe, or the buttons and button holes provided for the button shoe—machines doing the work in either case.

Meanwhile, the soles are cut, put through a "splitting" machine, and pressed, coming out with uniform thickness, smooth finish, and shaped to the sole of the foot.

Why the "Last" Comes First

The shoe is put together on a last, which is a wooden foot of the size and shape that the shoe is planned to fit. Workmen put the upper on the last, with the toe and heel stiffening in place, and little more is required to be done by hand. Thereafter, practically all that the workmen do is to pass the shoe from one machine to another.

Some of the most important machines are used in these remaining stages of the work. The "lacing" machine quickly laces the upper together to hold the sides in proper relation to each other. On the "pulling-over" machine iron fingers grip the upper and the lining, and pull them down evenly over the last where they are held by two tacks. The "lasting" machine smooths out all the wrinkles in the upper and tacks it in place. Then comes the most important machine of all, that which sews the upper to the sole.

The earlier machines for attaching sole and uppers were machines to nail or tack them together, but the nails wore through the insole and pressed into the foot. Wooden pegs were substituted for the metal nails, but there were still complaints. Today the soles are sewed to the uppers with the McKay stitching machine or the Goodyear welt-sewing machine. The Goodyear machine is considered the best of all, for the stitching leaves the inside of the sole perfectly smooth. In the Goodyear method the insole is fastened to the bottom of the last. The upper is then drawn over, with its edges reaching around to the edges of the insole. A narrow strip called the "welt" is fastened below these, and the outer sole is then sewed to the welt.

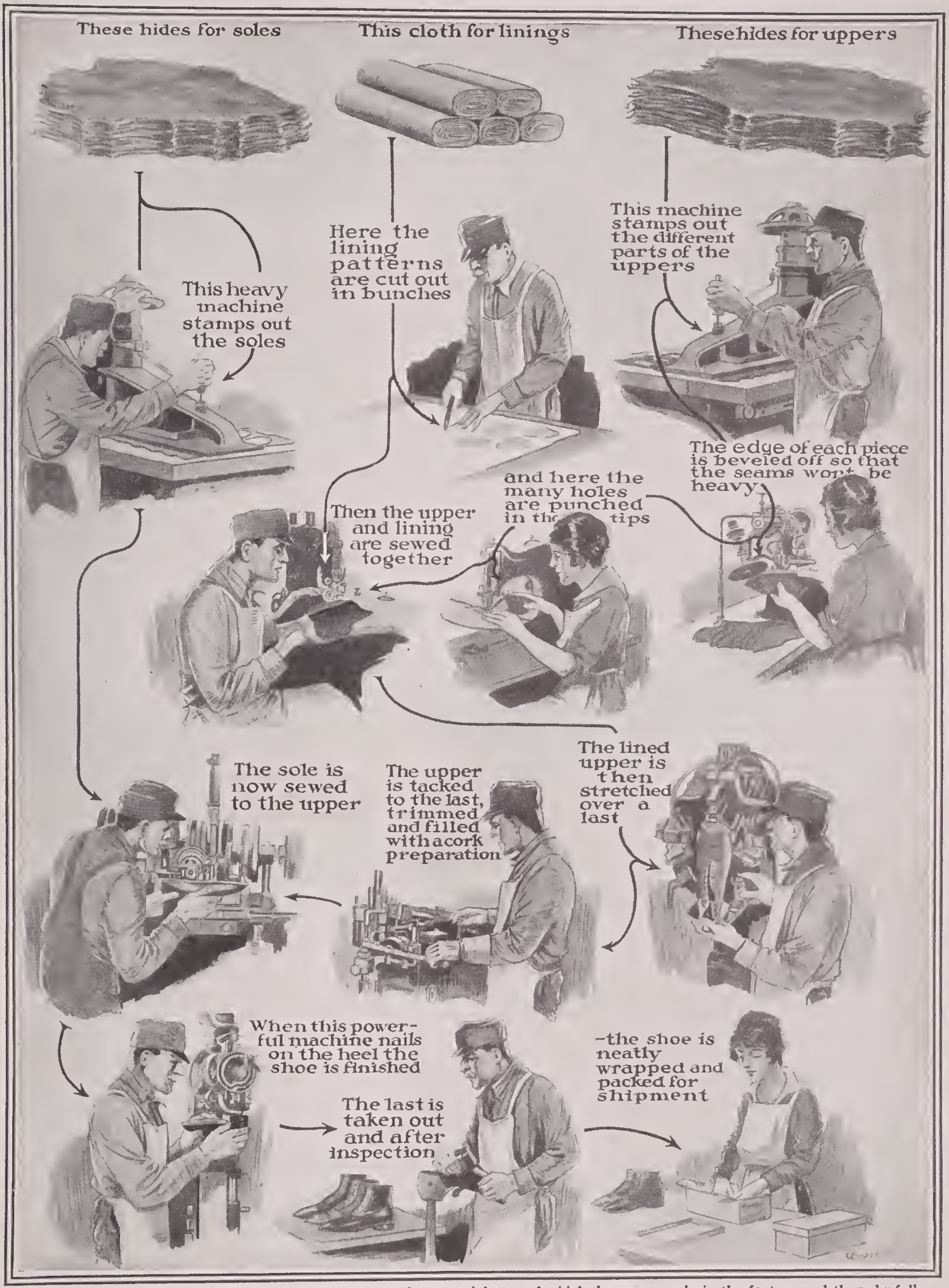
The shoe is now ready for heeling and this is done on the "lightning heeling-machine," so called from the speed with which it works. The heels are built up of different lifts of leather, cemented together, and put under pressure to make them durable and shapely. After the heels are put on, a "slugging" machine drives metal pieces or "slugs" into the bottom of the heel, at the places where most of the wear comes. Then machines grind the heel and the surface is smoothed with sandpaper and buffing machines.

The shoes with the soles and heels attached are then sent into the finishing room. There the soles are smoothed and polished; the uppers, sides of the heels, and the edges of the soles are blackened and polished; the trademark of the manufacturer is stamped on the sole—and the shoes are ready for market.

The Hand of Monopoly in the Shoe Business

The manufacture of shoes in a modern factory is practically dependent upon the wonderful machines we have been describing, all of which have been patented in recent years. A manufacturer cannot hope to compete in the shoe industry today if he cannot secure the use of these machines for his factory. With the introduction of the McKay sewing machine, some 50 years ago, the practice of *leasing* the machines grew up and this practice is now followed by the makers of practically all the shoe-making machines. Under this system the manufacturer cannot buy the machines which are essential in the shoe factory, but must operate them under a license or leasing agreement which provides for the payment to the owners of the patents of a royalty on the output of his factory. The amount of the royalties on these machines rises to enormous sums. Patents on many of the very important machines are in the hands of a few men and the absolute control of these machines puts great monopolistic powers in their hands. The right to continue this licensing system has been contested in the courts but the system was declared legal, so it will probably continue, until the period for which the patents are granted expires.

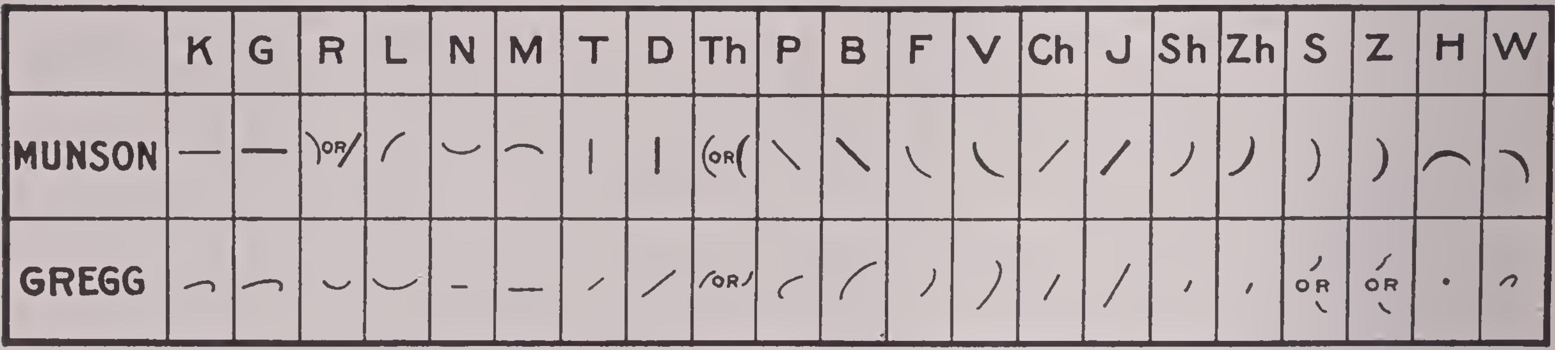
THE EARLY STEPS OF A SHOE


These hides for soles
This cloth for linings
These hides for uppers
This heavy machine stamps out the soles
Here the lining patterns are cut out in bunches
This machine stamps out the different parts of the uppers
The edge of each piece is beveled off so that the seams won't be heavy
and here the many holes are punched in the tips
Then the upper and lining are sewed together
The lined upper is then stretched over a last
The upper is tacked to the last, trimmed and filled with a cork preparation
The sole is now sewed to the upper
When this powerful machine nails on the heel the shoe is finished
The last is taken out and after inspection
-the shoe is neatly wrapped and packed for shipment

In the first three chapters of this picture story, you see the materials out of which shoes are made in the factory and then, by following the arrows, you can see how, step by step, the shoe walks into being, as it were, and finally goes into the box where you first meet it in the shoe store.

SHORTHAND. A very rapid writer of longhand can write only about 60 words a minute—a rate wholly inadequate for keeping pace with speech. By the use of shorthand, however, one who has just mastered the art can usually write 100 words a minute, and expert shorthand writers have made records of more than 250 words a minute. The average public speaker, it has been estimated, speaks at the rate of only 120 to 150 words a minute, and usually a business man in dictating his correspondence speaks slowly enough so that even a beginner who has carefully mastered every step in learning shorthand can keep pace with him.

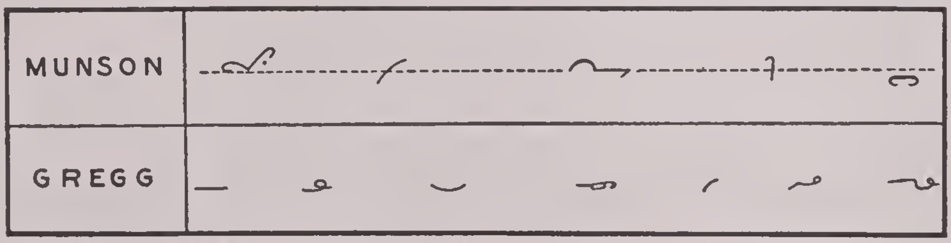
FIG. 1—THE SHORTHAND SYSTEMS COMPARED


K
G
R
L
N
M
T
D
Th
P
B
F
V
Ch
J
Sh
Zh
S
Z
H
W
MUNSON
OR
OR
GREGG
OR
OR
OR

The "Munson" system of shorthand, shown above, is a development from the original Pitman method. The Gregg system is comparatively new. By comparing a few of the symbols such as "T," "D," and "W" in the two systems, you can see the differences in character between the methods.

Forms of shorthand have been in use since very early times—just how early we do not know, but we do know that the orations of Cicero were taken down in some sort of shorthand by his secretary, a Greek slave. England is the birthplace of modern shorthand. From the 16th century on, various systems originated there, but it was not until Isaac Pitman in 1837 published the first work of "phonography," or writing by sound, that shorthand became a practical art. Of the several systems which are in general use today, all but one are "Pitmanic," or systems based on that of Isaac Pitman. The exception is Gregg shorthand, a system which rivals the Pitmanic systems in popularity. It was invented by John Robert Gregg and was first published in England in 1888.

FIG. 2—HOW A SIMPLE SENTENCE LOOKS



Here are the characters which the Munson or the Gregg stenographer sets down in a flash to express, "More rain will make the tree green." You will notice, however, that you cannot read either one by simply comparing the characters with those in the table above. This is because stenographers often use only a letter or two for a word—just as the "Gregg" writer used the letter "m" as a "word-sign" for "more."

Modern shorthand uses as few strokes as possible to a word, the average number in the practical systems of today being from two to three. The shorthand alphabet includes distinct characters for the representation of consonants, vowels, and diphthongs. Various methods of abbreviation are used, such as writing the most suggestive part of a word instead of the complete outline; using "word-signs," often consisting of a single stroke, for a large number of common words; and using short methods of writing prefixes and suffixes, such as *con*, *inter*, *tion* (*shun*), etc. Another expedient for gaining speed is "phrasing," or uniting two or more words in one outline.

There are certain fundamental differences between the Pitmanic systems and the Gregg. The former use "position writing," an expedient for expressing vowel sounds without writing them; the principal vowel sound in each word is indicated by the position in which the outline is written—whether above, on, or below the line. The Gregg system abolishes position writing by writing the vowel into the word in its regular order, without lifting the pencil; thus it may be legibly written on unlined paper. Another feature of Pitman shorthand is "shading," the heavy writing of an outline giving a meaning different from that of the same outline written lightly. The characters in Gregg shorthand are unshaded.

The consonant alphabet of the Pitmanic systems consists of straight lines and circular curves; that of the Gregg, of straight lines and elliptic curves. Where it is necessary to express vowels in the former systems, dots and dashes are used; and diphthongs are represented by acute angles pointing in various directions. The Gregg system uses what are called connective vowels—circles and hooks joined to the consonants in the order in which they occur in the word represented; and diphthongs are composed of combinations of circles and hooks. This tends to make the system elastic and adaptable.

The accompanying table (Fig. 1) shows the consonants in Munson shorthand (one of the Pitmanic systems) and in the Gregg system, respectively. In the Pitmanic systems *l* or *r* is represented at the beginning of a stroke by a small hook, placed on one side to indicate *l* and on the other side to indicate *r*. In the same way *n*, *f*, and *v* are represented by a small hook at the end of a stroke. When position alone might not make a vowel clear, dots and dashes are used. A heavy dot opposite the beginning (top or left) of a stroke is "ah," at the middle "ay," and at the end *ee*. A light dot represents short *a*, *e*, or *i*, a heavy dash *aw*, *oh*, or *ooh*, and a light one short *o*, *uh*, or *oo* as in "good."

Let us write the sentence "More rain will make the tree green" in Munson shorthand. It will look like the upper line in Fig. 2. For the word "more" we have the character for *m* preceded by the hook for *r* and written on the line (called "second position") to give long *o*. For "rain" we have the character for *r*, to which is joined the *n* hook, and the heavy dot in the center of the *r* indicates long *a*. The word "rain" is joined to "more" making a phrase. The word "will" is a word-sign—the letter *l* in third position (cutting the line). For "make" we have the letters *m* and *k* written in second position to indicate long *a*. The little downward stroke joined to the *k* is the word-sign for "the," and here we have another phrase. "Tree" is expressed by the letter *t* to which is joined the *r* hook and which is written in third position to indicate long *e*. For "green" the letter *g* is preceded by the *r* hook, followed by the *n* hook, and written below the line (also third position) to indicate long *e*.

Now let us take the same sentence in Gregg shorthand. It appears as is shown in the second line of Fig. 2. The letter *m* is a word-sign for "more." For "rain" we have *r* followed by the large circle, representing *a* and the character for *n*. "Will," as in the Munson system, is a word-sign composed of the character for *l*. "Make" is easily read, by a glance at the consonant table (Fig. 1), and the next character is the word-sign for "the." "Tree" and "green" should offer no difficulty, the small circle in each word representing the letter *e*.

In the last quarter of the 19th century machines for writing shorthand began to appear on the market. Several of these, such as the stenograph and the stenotype, have proved practicable and are extensively used. They are constructed so that all the keys may be depressed at the same time, and a code has been developed so that a whole word may be written at one stroke. When an operator has memorized the abbreviations he is able to acquire as good speed as by the use of shorthand.

SHRIKE. The "butcher-bird," as the shrike is commonly called, hangs his victims—field-mice, frogs, small birds, lizards, or insects—on thorns or barbed wire, or fastens them in a tree crotch, the better to tear them in pieces. This peculiar habit is due to the fact that the shrike's claws are small and weak, and so he must have some way of holding his food while he tears it into pieces small enough to eat.

Shrikes have few likable traits. They are regular Bluebeards and often kill for the mere love of killing. As a family, they are classified with song birds, but the call note is harsh, and only a few species sing.

These birds are about ten inches long. The plumage, never bright, is generally gray or brown, varied with black and white. The sexes are usually alike. The bulky nest is placed in a tree, usually among thorny twigs or intertwining vines. The white eggs, four to seven in number, are spotted with olive brown.

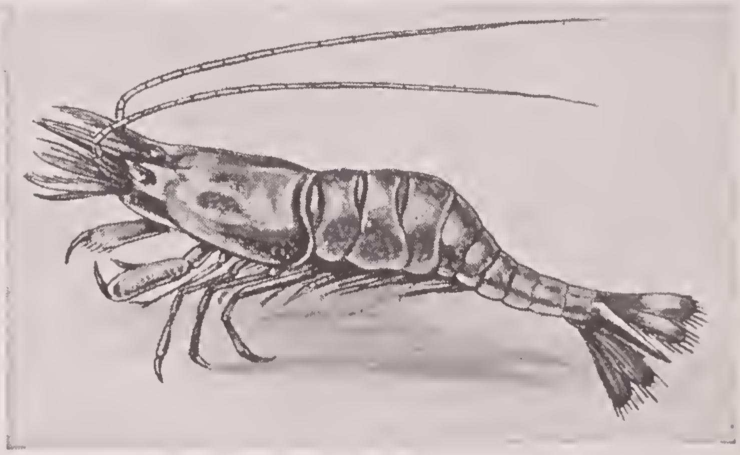
Shrikes are widely distributed throughout the Northern Hemisphere, and in parts of the African and Indo-Malayan regions. In the Western Hemisphere none are found south of Mexico, and but two species occur in America, the northern shrike and the loggerhead shrike. Of these the loggerhead shrike is the more southern form and the best known. (For illustration in color, *see* Birds.)

Of the Old World species the "great gray shrike" of Europe, pearl gray and white, with black wing and tail feathers, is well known. The small "red-backed shrike" is found in Great Britain. The male of this species has a gray head and neck, rust-red back, and pale rose breast; the female is dull brown.

Scientific name of northern shrike, *Lanius borealis;* of loggerhead shrike, *Lanius ludovicianus.*

SHRIMP. Shrimps, of which there are many varieties, are close relatives of the crawfish, belonging to the class of crustaceans. Their home, however, is in salt water. Shrimps are about two inches long and have tiny paddle-like legs for swimming, long delicate feelers on the head, and a funny little humpbacked, greenish-gray body that ends in a diminutive finlike tail. They play about in pools left by the tide, or bury themselves in the sand, and are easily taken in seines or traps set along the ocean beach. The flavor of their tender flesh makes them a highly prized table delicacy. Canned or dried, shrimps are shipped to all parts of the world. The largest shrimp fisheries are on the north Atlantic coasts of America and Europe, in Louisiana, and in San Francisco Bay.

A SALT WATER COUSIN OF THE CRAWFISH



A Shrimp, if you meet him canned, looks something like a little pink doughnut. By straightening him out, putting on his shell again, adding a tail and legs and feelers, and returning the natural greenish-gray color to his suit, you have him as he is here and as he looks in his native waters. Fresh shrimps are usually served with their original anatomy but little disturbed, and it's quite a little trick to get them out of their shells, but it is well worth the trouble if you like their delicate flavor.

Prawns are big cousins of the shrimp. They grow to be 5 inches long, in the tropics even reaching a length of 20 inches. They are beautifully tinted in light shades. The flesh, equally esteemed with that of the shrimp, turns a pink color when cooked.

Scientific name of the common shrimp, *Crangon vulgaris;* of the American edible prawn, *Palaemonetes vulgaris.*

The LAND of the SACRED WHITE ELEPHANT

Sacred Elephant in "Swing" Festival Procession, the Siamese Thanksgiving

SIAM (*sī-ăm'*). The sacred white elephant, whose image waved on Siam's red flag until 1918, is still found at times in the trackless mountain forests of that remote land, along with the tiger, the leopard, the wild cat, and the rhinoceros. Monkeys chatter in fear as they flee before monstrous pythons gliding from branch to branch. Peacocks make the somber green depths seem yet more somber in contrast with their vivid plumage. The black-haired brown-skinned natives, their teeth and lips stained red with betel-chewing, still hold to the ways of their forefathers, keeping their dead embalmed in great jars for months before cremation, marrying their boys at 17 and their girls at 14—mature ages as compared with India—dressing in single kiltlike garments hanging from the hips, eating their simple rations of rice and fish with their fingers, and getting their chief delight out of cock-fights and fish-fights.

But the ancient kingdom of Siam, like other countries of the Orient, is fast being transformed by Western influence. Bangkok, the capital, is a cosmopolitan city of the world, and even in many of the remoter regions the natives count the "movie" as one of their favorite diversions. The security of Siam in recent years is due to the fact that it, like Afghanistan, is a "buffer state" between two great European powers—British Burma on the west and French Indo-China on the east. (For map *see* Asia.) For centuries it was hampered by constant wars with native peoples on its loosely defined frontiers; but since 1896, when France and Great Britain guaranteed its independence and neutrality—leaving it the only independent nation of the Indo-Chinese peninsula—Siam has been free to apply itself to internal development. Under the enlightened rule of its king, who governs as an absolute monarch without a constitution, roads and railways are being built, agriculture fostered, and education advanced. British, French, and American advisers have greatly assisted in improving the various departments of the government. The Siamese are far from an uneducated people, for most of the men can read and write a little in their alphabetized native language, akin to the Chinese—the result of the instruction of foreign missionaries as well as that of the patient Buddhist priests of the innumerable monasteries. But under the new régime all schools are under governmental supervision, and several professional institutions have been established. Many of the brightest graduates are sent every year to complete their studies in the universities of Europe or America.

The surface of Siam (except the narrow strip of Lower Siam, which forms the northern part of the Malay Peninsula) is shaped much like a hand. The fat thumb, to the east, is a low plain of desert scrub and stunted forest, inclosed by hills and the Mekong River. In this plain 2,000,000 people, perhaps the poorest peasantry in the world, eke out a bare living. The fingers are the northern mountain ranges, whose heavily forested slopes, worked by the sturdy hill tribes, produce the major part of the world's supply of teak-wood, as well as ebony, rosewood, rattan, and ironwood. The logs are floated down the Salween into Burma, or to the port of Bangkok, on the Gulf of Siam by way of the Menam River, "the mother of waters," which is to central Siam what the Nile is to Egypt, serving as the chief trade route and covering the plains with fertile soil when it overflows.

A network of east-to-west canals links the farthest villages of this region with the Menam and two other large rivers, taking the place of roads and helping to a certain extent to irrigate the land. Irrigation is backward, however, for no system exists in most of the country for raising the water onto the fields. Rice of the finest quality is grown here. Nearly the whole population, outside Bangkok, is engaged in growing "paddy," as unhusked rice is called in that part of the world. More and more of the reed and bamboo jungles, sometimes under water for three months of the year, are being cleared for rice. Enough corn and tobacco for their own use is also grown by the Siamese. The towns about Bangkok ship sago, sugarcane, coconut, and betel, and immense quantities of the tropical fruits for which Siam is famous—bananas, jackfruit, mangoes, breadfruit, pineapples, guavas, durian, and the delicious mangosteen. The rich mineral resources include tin, tungsten, gold, iron, copper, and the famous Siamese sapphires and rubies; except for tin the mines are little developed because of the unhealthful tropical climate. Three-fourths of the foreign trade is with Great Britain and her colonies, which every year, in return for Siam's products, supply many millions of dollars' worth of cotton goods, oil, silk, and machinery and other manufactures.

"A FLYING ANGEL"

A play in Siam consists largely of dances representing historical and mythological subjects, such as the march of armies, or the triumph of a conqueror. This young dancer is one of a ballet corps depicting the flight of angels.

The present area of Siam is now about 200,000 square miles (about twice the size of Colorado). It has a population of nearly 9,000,000, of whom nearly 1,000,000 are Chinese coolies and merchants. The pure Siamese are estimated at about 2,000,000; the rest of the population are Laos, Burmese, Cambodians, Malays, and Annamese, hardly distinguishable from the Siamese. The Siamese are short and stocky, with their eyes slightly slanted. They are Buddhists, and closely resemble their Burmese neighbors in having a passive easy-going temperament and giving their women much freedom. There is no caste system such as is the curse of India. As in Burma, there are numerous Buddhist monasteries, and the temples of teak with gilded roofs resemble those of Burma in symmetry. The people are, however, not so industrious as the Burmese, and most of their trade has fallen into the hands of the Chinese.

Siam aligned itself with the Allied powers in the World War of 1914–1918, declaring war on the Central powers in 1917 and seizing interned German vessels.

SIBERIA. Siberia has been to Russia what the great West was to the United States and Canada—a region of vast undeveloped resources and immense possibilities. Stretching away from the Ural Mountains to the Pacific Ocean, and from the populous lands of southern Asia to the Arctic Ocean, Siberia's lonely steppes, forests, and frozen tundras, with an area estimated at 4,832,000 square miles, exceed in extent the whole of Europe. In 1580—27 years before the

A SIAMESE FREIGHT TRAIN

This is a pack train passing through a village in Siam. In the interior of that land bullocks are the beasts of burden, equipped with twin baskets astride their patient shoulders.

first English colonists landed in America—the victories of the Cossack bandit Yermak over Tatar tribes east of the Urals opened Siberia to Russian occupation. Gold hunters, trappers, fur traders, fugitive serfs, and later transported criminals supplied the elements of a natural and peaceable expansion. "To become a colonist," said the historian Rambaud, speaking of the earlier days, "there is no ocean to cross, no steamboat fare to pay. The poorest peasant, a staff in his hand, an axe at his belt, his boots slung from a cord over his shoulder, can pass from one halting place to another until he reaches the ends of the empire." Yet the country at the time of the Russian Revolution was scarcely more developed than the American West of 50 years ago, the population of more than 10,000,000 being less than three to the square mile.

Western Siberia is a continuation on the same grand scale of the plains of European Russia, with tundras (or Arctic moorlands), great forests of birch, larch, silver fir, and other conifers, an agricultural black-earth belt, and rolling grassy steppes (*see* Russia). Eastern Siberia is rugged and mountainous or a broken table-land, with higher mountain chains or mountainous plateaus on the south and southeast. Four out of the five largest rivers of Asia, the Ob, the Yenisei, the Lena, and the Amur, drain Siberia; no other country in the world except Brazil has so many great water courses. Each receives two or more great navigable tributaries, and the upper branches of the huge treelike systems of the first three are separated only by short portages—a fact which greatly facilitated exploration and early settlement. Like Russia, Siberia has many lakes and immense swampy tracts. Lake Baikal, with a length of 386 miles, an area of 13,330 square miles, and a greatest depth of nearly 5,000 feet, is the largest fresh-water lake in Asia.

Lying in the latitudes of Labrador and Alaska, open to the Arctic Ocean but walled off by mountains to the south, with immense plains over which the terrible *burans* or snowstorms can sweep unchecked, Siberia's harsh climate is proverbial. Average winter temperatures range from 53 degrees below zero to 2 degrees above. Agriculture is impossible in the northern third, and is hampered by drouth in some portions of the interior and by excessive moisture on the Pacific coast. In the southern part of western Siberia, however, during the hot brief summer—too short for apples and pears—grain and vegetables grow like magic. Wheat, live stock, beef, and eggs are exported in large quantities; the export of butter alone in one year before the World War amounted to more than $30,000,000.

Siberian furs are abundant and especially rich, soft, warm, and light. The dense forests are an almost untouched source of lumber. Rich deposits of coal, iron, copper, lead, silver, gold, platinum, graphite, tin, zinc, salt, mica, and precious stones are only slightly worked. Ivory is "mined" on the Arctic coast of Siberia, where vast stores of the remains of prehistoric animals are preserved in alluvial drift.

Manufactures are insignificant because of the general backwardness of the country, and particularly of transportation. The magnificent rivers are navigable for thousands of miles, but the Ob, the Yenisei, and the Lena, emptying into the bleak Arctic Ocean, are not channels of communication with other countries, while the Amur is cut off by a great plateau from the Siberian plains; besides, all are frozen for many months in the year. The completion of the Trans-Siberian Railroad (1891–1905) gave a great impetus to the development of the country; before the World War began, more than 10,000 miles of rail had been laid in Asiatic Russia.

WHERE THE "SIMPLE LIFE" IS THE UNIVERSAL RULE

Life in the remoter Siberian villages, such as this, is beset by many hardships. Few of the comforts of civilization are known, and even the planks of which the cottages are made have to be hewn from the log by hand. Glass is so expensive and the long Siberian winters are so bitter that most of the houses are built with only one or two small windows. The low carriage, with a yoke at the end of the shafts, is the typical summer conveyance, as it is also in European Russia.

About two-thirds of the inhabitants are Russians and the rest consist of various native tribes of Tatar, Turk, Mongol, and other non-caucasian stocks. The conquering Mongols of the 13th and 14th centuries came from the Baikal region.

Peter the Great began the practice of exiling political prisoners to Siberia, and early in the 19th century ordinary criminals were deported thither. Late in the 19th century the government encouraged voluntary immigration. Among the important towns that grew up to populations of 100,000 or more are Irkutsk, the capital, Omsk, and Tomsk. The chief port is Vladivostok, on the Pacific coast (*see* Vladivostok). After the Russian revolution in 1917 Siberia was plunged into political chaos, serving as a base for various Bolshevist and counter-revolutionary movements, and for Japanese intervention and occupation in eastern Siberia. A Far Eastern Republic was established embracing the territory east of Lake Baikal, with the capital at Chita.

SIBYLS (*sĭb'ĭlz*). According to an old Roman tradition, the Cumaean Sibyl or prophetess came from the east to the Roman King Tarquin the Proud, offering nine books of prophecies but at so enormous a price that he refused to buy. She then destroyed three, and offered the remaining six at the same price, and was again refused. Destroying still another three, she asked as much for the three left and Tarquin's fear and curiosity finally induced him to buy. They contained advice regarding the religion and government of the Romans and were carefully guarded in the temple of Jupiter and consulted on occasions of national emergency. When the temple was burned in 83 B.C. a new collection was made of about 1,000 lines, gathered from all the cities of Greece, Italy, and Asia Minor, which was kept until some time between A.D. 404 and 408, when the Christians caused it to be publicly burned.

Several other sibyls or inspired prophetesses are named by various Greek and Roman writers. Legend said they lived to an incredible age. The Sistine Chapel in Rome contains world-famous wall paintings by Michelangelo of the Cumaean, Delphic, Persian, Libyan, and Erythraean sibyls.

SICILY (*sĭs'ĭ-lĭ*). On the walls of a Moorish palace in the Sicilian city of Palermo runs this legend: "Europe is the glory of the world, Italy of Europe, and Sicily the fairest garden of the Mediterranean." This "fairest garden" is the largest island in the Mediterranean. Mount Etna, which dominates it now as always, looks down upon an unsurpassed panorama of curving bays, shining cliffs, and crowded fishing villages perched like nesting sea-birds among rocks and crags. The landscape shows rugged mountains dark with evergreen, and rounded hills gray-green with olives and terraced vineyards, as well as yellow sun-baked plains and valleys carpeted with orchids, iris, and anemones, and many quaint old towns and cities.

Picturesque towns are these, with their vine-covered walls, their gardens and fountains, and their ancient palaces and churches, flooded with sunshine and the heavy fragrance of flowers. At Etna's foot, on the east, directly across the Messina Straits from the toe of the Italian boot, lies Messina. This great seaport was founded by the Greeks about 600 B.C. under

A RUINED MEMORIAL OF THE DAYS OF THE GREEKS

At Taormina on the east coast of Sicily, you may see these ruins of a theater which was originally built by the Greeks. But while the columns are Greek, the arches you see are Roman, for the original theater was entirely reconstructed by the Romans. From these ruins you get a beautiful view of Mount Etna in the background.

the name of Zancle (the Greek word for "sickle"), referring to its peculiarly shaped harbor. From the earliest times it has been of commercial importance. Even the ancient Phoenician trading vessels threaded their way between the fabled rocks of Scylla and the perilous whirlpool of Charybdis in the straits outside the harbor. Messina today is a wealthy modern city humming with industry. Its inhabitants have shown their pluck in the face of centuries of disasters, culminating in the terrible earthquake of 1908 which almost completely destroyed the city. More than 77,000 persons were killed and about 80,000 were injured. Famine and pestilence, following in the wake of the disaster, caused many more deaths.

Near Messina, along the eastern coast, is Taormina, perched on the rocks like an eagle's nest, 700 feet above the Ionian Sea. Far to the south past Catania stretch yellow plains to the famous Syracuse, once the greatest city of Sicily, now reduced to a mere shadow of its ancient splendor. Across a temple-crowned shell-shaped valley on the southwestern coast lies Girgenti. On the northwestern coast at the mouth of the orange-bowered "Golden Shell" valley lies Palermo, the largest city in Sicily and the fifth largest in Italy. Its population is about 346,000.

Palermo may fittingly be called "the melting pot of the Mediterranean," for the Phoenicians, Carthaginians, Greeks, Romans, Goths, Saracens, Normans, French, and Spaniards who have ruled there have all left their marks on this old-time city. Its beautiful harbor is filled with fishing boats with bright-colored sails, and great steamers loaded with lemons and sulphur. In the streets tourists mingle with gaily costumed peasants, who look like grand-opera heroes with their bright sashes and gay shirts, proudly riding in their wonderfully carved and gaudily painted two-wheel carts drawn by donkeys covered with plumes and tinseled harness. Palermo has other interests, too, besides its commercial ones. The University of Palermo, founded in 1779, has recently risen in importance and now has more than 1,000 students. The city is a military post and has a large arsenal. Near by is a royal winter palace.

The Power of the Mafia

Because the elementary schooling is so poor many of the Sicilians—especially the sunburnt fishers, mountaineers, and other poor but picturesque peasants—are very illiterate. The poor laborers—notably the sulphur workers—have a very hard time, and many of them leave their sunny island and go to the United States. The Mafia, a powerful secret organization which terrorized the entire island and even has its secret agents in the United States, is the curse of Sicily, as the Camorra is of Naples. By boycotting or by violence the Mafia controls elections and trials, protects its members from officers of the law, and often prevents non-members from securing employment. Most of the crimes in Sicily and many of the mysterious murders in the Italian quarters of American cities are laid at its door.

Sicily's history is a tale of changing masters, of conquests and cruel oppression. It was first great under the Phoenicians nearly 3,000 years ago. With the Greeks, who arrived in the 8th century B.C., came Sicily's intellectual "golden age." The poet Theocritus, the philosopher Empedocles, and other great men of Greece trod her streets, and beautiful Grecian temples were built. Then came the Carthaginians, who soon had to yield to Rome. Vandals and Goths found their way across the narrow straits from the mainland, pillaging and destroying. Then the Byzantine rulers of Constantinople sent armies to drive out the barbarians and held the island against the marauders for a brief period.

With the Saracens in the 9th century came a new epoch. Agriculture, industry, and commerce once more flourished. Then the battle for Sicilian soil began again. First of the invaders from the north were the Normans. Under Emperor Frederick II (1197–1250) Sicily attained what was perhaps the zenith of her culture, at this time becoming, indeed, the cradle of Italian song, and one of the first of modern states. Sixteen years after Frederick's death Charles of Anjou overthrew the last of the Hohenstaufen dynasty, but his cruelty and oppressive taxation greatly angered the Sicilians. Matters came to a crisis on the day after Easter in 1282, when, as the vesper bells were ringing, the people of Palermo massacred 4,000 of their French oppressors. Massacres in other parts of Sicily followed this famous "Sicilian Vespers," after which independent Sicily chose Pedro III of Aragon for king.

A Long Period of Misrule

Spanish, French, and Austrian despots then brought a long period of darkness and stagnation. In 1734–35 Don Carlos established the Bourbon dynasty in Naples and Sicily, uniting the two territories under the name of the Kingdom of the Two Sicilies; and down to 1860 Sicily was governed by Bourbon kings. Then Garibaldi with his thousand "red shirts" came to deliver the Sicilians, finally annexing Sicily to the dominions of Victor Emmanuel, which a year later became the Kingdom of Italy. The island is now divided into seven Italian administrative districts or provinces.

Sicily is separated from the Italian mainland only by the narrow Strait of Messina (*see* map of Italy). It is a fragment of the long narrow land-link which in prehistoric times joined Italy to Africa. Its area of 9,935 square miles is a little greater than that of Vermont. Its chief exports are sulphur, fruits (grapes, olives, oranges, lemons, etc.); fish (a great supply of tunny, sardines, as well as sponges and corals, are taken from Sicilian waters); wine, oil, sumac, and salt. Population, about 3,800,000.

SIEGFRIED (*sēg'frēd*). Long, long ago, in a gloomy cave hidden away in the forests of the Rhineland, there lived Siegfried, a kingly youth, tall and strong, with fair hair and blue eyes. His only companion was Regin, a swarthy dwarf who had reared him.

When Siegfried attained manhood Regin told him of his parentage, that he was the orphaned son of a fearless king who had died gloriously in battle. "The time has now come," Regin said, "when you must leave the forest and go in search of adventure in the world." Nothing loath, Siegfried prepared to depart, but first he asked that Regin make him a trusty sword. Regin, who was a skilled smith, straightway began to forge a sword for Siegfried, but when he had finished it the youth easily shattered it by striking it on the anvil. Three others met the same fate.

"If I am to do battle," said Siegfried, "I must have a sword worthy of my strength." Thereupon Regin took the broken pieces of the sword which had belonged to Siegfried's father, filed them into steel dust, and from this with all his art he made a wonderful shining blade. This also Siegfried tested by bringing it down with a mighty blow on the anvil. It was not broken, but the anvil was cut in two.

Fafnir, the Terrible Dragon

In the long evenings Regin had told Siegfried of the fearful dragon Fafnir who guarded in his cave a priceless treasure, slaying those who tried to gain it. To the den of the dragon Siegfried now made his way. When Fafnir heard him approaching he roared until the ground trembled. Nothing daunted, Siegfried guarded himself from the maddened rushes of the hideous creature, until with a thrust of his sword he so wounded the dragon that it at last fell dead. Siegfried thus gained the treasure which the monster guarded. By bathing himself in the blood of the slain dragon he became proof against wounds, excepting in one small spot between the shoulders where a linden leaf had fallen. Accidentally tasting the blood, he discovered that he was able to understand the language of the birds and beasts, and by eating the monster's heart he was endowed with even greater strength. According to another story the treasure which Siegfried gained was obtained by slaying the kings of the Nibelungs (*see* Nibelungs, Song of the).

After performing many other great feats Siegfried at last came to the court of Gunther, king of the Burgundians, where he was greeted as a hero, with feasts and all honor. He wedded Kriemhild, sister of Gunther, a maiden of marvelous beauty, and became the most heroic and beloved knight in Gunther's kingdom. But among the king's vassals was one, Hagen by name, who was jealous of Siegfried's glory. By clever lies he induced Gunther to believe that Siegfried would some day steal his power, so the king agreed to help destroy Siegfried.

Knowing that there was but one place in which Siegfried could be wounded, Hagan treacherously played upon Kriemhild's fear for Siegfried's safety on the battlefield, and begged her to tell him of the fatal spot, saying, "I ride close behind your lord in battle, and should the fight wax fierce, knowing his vulnerable spot I might protect him." Kriemhild innocently disclosed the secret, and unknown to Siegfried she sewed a tiny cross between the shoulders of his tunic. The dauntless hero thus became an easy prey to those who sought to slay him. Gunther arranged a hunt, and the cowardly Hagen thrust a spear into the fatal spot, while Siegfried lay drinking from a woodland stream. Mortally wounded, Siegfried attacked Hagen but died before he had avenged himself. The whole kingdom mourned Siegfried's loss, and it is said that even the gods sorrowed and there fell upon the earth a gloom that lasted for many days. This story is the theme of one of the musical dramas of the composer Richard Wagner.

SIERRA (*sĭ-ĕr′ȧ*) **NEVADA.** The loftiest and grandest mountain range in the United States, the Sierra Nevada ("snowy range") forms a great wall extending for nearly 500 miles in the eastern part of California between the deserts of the Great Basin and the rich grainfields and orchards of the Sacramento and San Joaquin river valleys. The eastern slope plunges abruptly to the plain 5,000 feet below; the western has a wider, more gradual slope, covered with forests. The crest is a line of sharp snowy peaks.

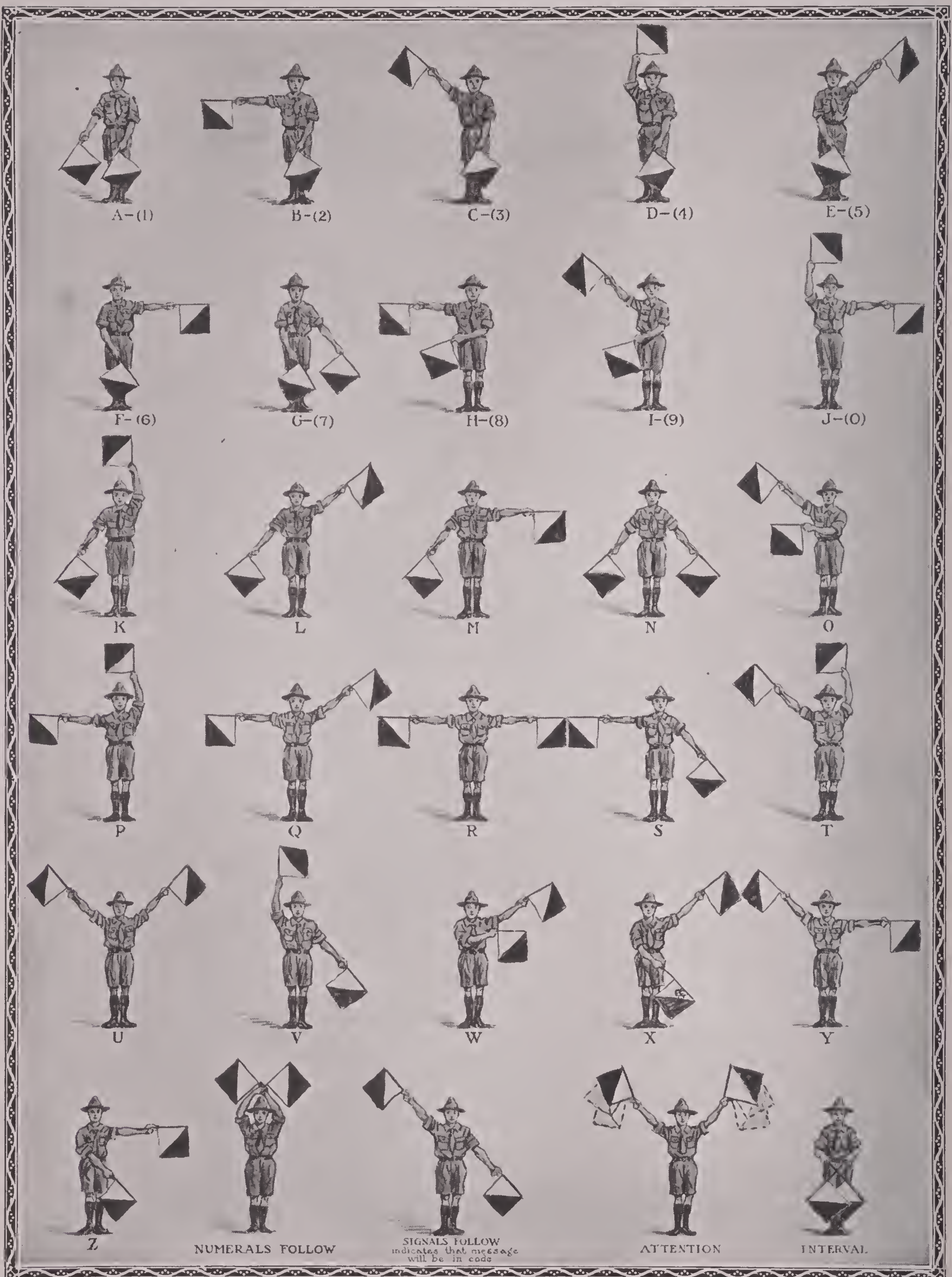
Mount Whitney, near the southern end of the range, is the highest peak in the United States (outside of Alaska), attaining a height of 14,502 feet, and there are a number of other peaks more than 13,000 feet high. Mount Shasta at the northern extremity is an extinct volcanic cone, almost as high as Mount Whitney, with a crater about 2,500 feet in depth and 3,500 feet in diameter. Not far south of it is Lassen Peak, the only volcano in the United States proper which is still active. Many of the summits are clad in perpetual snow, and there are some small glaciers.

Fed by the heavy snowfall, many torrents have cut their way down the western slope, forming deep canyons. In other places great chasms have been formed by the splitting asunder of the rocks or hollowed out by glaciers. Among the valleys the Yosemite is the most famous and the most magnificent (*see* Yosemite Valley). The lower western slopes are covered with oaks and other deciduous trees; above these, to a height of 9,000 feet, are dense forests of many kinds of evergreens, including the giant sequoias, the largest trees in the world (*see* Sequoia). The range was named by the Spanish settlers after the Sierra Nevada in southern Spain, the highest mountain range in that country.

SIGNALING. Even the most primitive of peoples have always had systems of signaling by which they could transmit information over long distances. For short distances the early signals were chiefly gestures or signs with the hands or body. For longer distances, especially in warfare, beacon lights, such as fires and torches, were used, as well as smoke columns, the display of shields, spears, banners, etc. Who has not pictured on the background of romance the beacon fires by which the Indians, signaling from one mountain peak to another, summoned their councils?

These early methods seem crude indeed in comparison with the modern telephone and telegraph.

THE "TWO-FLAG" SEMAPHORE SIGNALS



Here are the positions you would use in sending a message by means of two hand-flags. You will notice that the first ten designate both letters and numerals. The rule is that these positions usually designate letters; but if you give the "numerals follow" signal each subsequent position means a numeral, until you give an "interval." Then each position means a letter. The method is exceedingly rapid and is not very difficult to learn.

But even today various signal systems are in use and are of the greatest importance, especially at sea, in military operations, on railroads, and in weather bureau activities.

At sea, signaling is one of the important phases of navigation. Most nations have adopted the International Signal Code, comprising an alphabet of flags in variously colored designs, and a 27th flag or answering pennant. Three flags are generally used for each signal. When the flag colors cannot be made out—they are visible for only about three miles—other systems are used. Little cones, balls, and drums may be fixed in vertical arrangements, or a fixed "semaphore"—a post to which one or two mechanical arms are attached—may be operated.

Before the invention of the electric telegraph, the semaphore was extensively employed in Europe as a means of transmitting messages. Codes for spelling out any message were devised, in which different positions of the signal arms stood for different letters. The semaphores were set far apart and operators observed the changing signals through telescopes. A system of this kind between Lille and Paris conveyed messages 130 miles in a few minutes. Today, however, the semaphore finds its principal use as a signaling device on railroads.

Signals Used at Sea

The United States Navy makes considerable use of a signaling system which is based upon message books. The books contain almost all the communications a ship might want to make, and in signaling from one ship to another it is only necessary to indicate by flags the book and the number in the book corresponding to the required message. Nine rectangular flags, representing digits from 0 to 10, and three triangular pennants called repeaters are used. In addition there are special flags—annulling flags, convoy flags, position pennants, etc. Hauling down the ensign indicates the completion of a signal. One of the commonest systems for short distances is the "two-flag semaphore," in which a sailor, perhaps standing aloft on a signaling bridge, waves two square flags, one in each hand, the positions of the flags indicating the letters of the alphabet. In the one-flag "wigwag" system, the dots and dashes of the International Morse Code are used, with a movement of the flag to the right for a dot and to left for a dash.

Night signals include red and green fireballs or stars, which are shot to a height of about 400 feet and are visible for 10 miles or more, and red and white lights. White lights are also flashed from "blinker lamps," the long and short flashes indicating dashes and dots. Ships below the horizon as much as 60 miles distant may be signaled by turning a searchlight beam upon the clouds.

But the wireless telephone and wireless telegraph have largely displaced the older methods of signaling, particularly in distress signaling. A famous instance of the latter was the "S O S" signal of the sinking *Titanic*. The call brought the steamer *Carpathia* speeding over miles of water in time to rescue many of the ill fated liner's passengers.

In fogs and storms, signals are sent out at regular intervals from ships and shore stations by bells, sounding horns, sirens, or whistles. Scientists are also developing methods for submarine signaling, in order to take advantage of the fact that sound is conveyed more uniformly through water than through air. Submarine signals usually are made by strokes of a bell or beats of a metallic drum, immersed far enough below the surface to be free from wave disturbances. The ship picks up these sounds by means of microphones, or sensitive receivers, hung in water tanks inside the ship's bows. These microphones are electrically connected with an indicator box in the pilothouse or chart room. Such signals are used to indicate the presence of shoals, harbor mouths, nearby ships, etc.

Signaling in the Army

Except within regiments and smaller units, signaling in the United States Army is the work of a special branch, the Signal Corps, founded in 1860. Army signals include the wigwag, wireless telephone and telegraph, the field telephone and telegraph, "blinker" lamps, ground induction sets, lanterns, rockets, bombs, semaphores, searchlights, and elaborate sets of signals for exchanging information between aviators and the ground. The airmen give signals by means of wireless telephone and telegraph, smoke bombs and streamers, and receive signals from the ground by means of cloth strips laid out in different patterns, blinker lamps, and flares. Another of the Army signaling devices is the heliograph, an instrument in which a mirror reflects the rays of the sun cast upon it. Messages are sent by short and long flashes, corresponding to the dots and dashes of the Morse Code.

The Army uses both the International and the American Morse Codes, and both the Army and the Navy have secret codes and signals of various sorts. The Boy Scouts use the International or General Service Code, as it is more often called, with one flag, and the two-flag or Semaphore Code.

SILICON. This element might well be called "the earth-maker," for the earth's crust is composed largely of a combination of silicon and oxygen called silica (SiO_2). Quartz, which occurs both by itself and as a constituent element of granite, is a crystalline combination of silica and water, while sand, clay, and most other forms of soil contain silicon in one combination or another. Silicon never occurs free in nature, and its combinations are rarely found in living substances.

In the arts and industries, silicon is important because in the form of silica it enters into the composition of many precious stones, glass, and varieties of earthenware. Silica colored with other materials gives amethyst, cat's-eye, jasper, chalcedony, agate, carnelian, onyx, and opal. Glass consists of varieties of silica fused with other materials, and in the finished product silica constitutes from 50 to 75 per cent of the whole. Clays contain from 45 to 60 per cent silica.

When united with equal parts of carbon in the intense heat of an electric furnace, silicon yields the artificial substance carborundum (SiC), which is next to the diamond in hardness, and is widely used for whetstones, grinding wheels, and polishing and abrading powers. Carborundum was first obtained by accident in 1891 by E. C. Acheson, an American who was trying to make artificial diamonds. It is so resistant to heat that a coating of carborundum and fire clay one-twelfth of an inch thick is said to be able to protect the brick lining of a furnace against any heat ordinarily used, even in melting iron and steel. Carborundum is made at Niagara Falls, by fusing a mixture of 34 parts of coke, 54 of sand, 10 of sawdust, and 2 of salt for 36 hours in an electric furnace.

Pure silicon may be obtained by chemical processes either as a non-crystalline brown powder or a crystalline gray one. Silica united with hydrogen and oxygen in the form H_4SiO_4 constitutes silicic acid, which acts upon many substances to form silicates. Silicates form the principal minerals in soils.

Silk Worm

THE LITTLE SPINNER
and
Its Dress of Silk

Silk Moth

SILK. Once upon a time a dainty little empress sat in her garden watching the sun shining down on her mulberry trees, while the fountains bubbled with laughter and the wind brought to her the fragrance of the spring. This empress lived more than 4,500 years ago, the story goes, in Hang-Chow-Foo, the "City of Heaven," which was the old southern capital of China, and her name was Si-Ling-Shi. Presently she saw a caterpillar on one of the branches making for himself a beautiful little house with threads spun from his body.

All day long the empress watched the caterpillar. She saw that from the under side of his head flowed a shining thread, which he wrapped around and around his body until he was all enclosed in a delicate little cocoon which looked as if it had come from fairyland.

"But the whole beautiful thing is just one long thread, wound as if on a distaff!" cried the empress. "If I could only unwind it, what an exquisite fabric it would make! Why couldn't I? I believe I could, for there is not one little tangle in it. It just needs patience."

FOOD FOR THE SILKWORM GUESTS

After Lady Moth has laid her eggs and after these eggs have turned into the little worms that spin the silk, comes the busy time of the gatherers of mulberry leaves. These Japanese are gathering a load for the voracious babies, who eat their own weight in mulberry leaves every day of their lives!

So she coaxed the emperor to give her a grove of the choicest mulberry trees. And there she worked, carefully gathering the tiny eggs of the silkworm moths, and when they were hatched picking with her own hands the tenderest leaves for the baby worms to eat, until the time came when they, too, had spun their exquisite cocoons. And one happy day she succeeded in twisting together the strands from a number of the little silk balls into many long threads. Hundreds of yards she wound off, and from them she wove a wondrous shimmering fabric more beautiful than any that had ever been seen before. To this day it is called "si" in China, "soie" in France, and "silk" in English-speaking lands, in honor of clever Si-Ling-Shi.

All over China the culture of the silkworms spread, and when the empress died the southern part of the empire was a bower of mulberry trees, and Hang-Chow-Foo was famous for its beautiful silks and embroideries. The empress was placed among the Chinese deities as the "Goddess of the Silkworms," and every year when the mulberry leaves open there is a feast day in her honor.

While this is only a legend, it bears witness to the fact that silk culture was known in China from a very early time. For more than 2,000 years the

Chinese manufactured silk and sold it to their neighbors in Japan, India, and Persia. But the secret of how it was made was faithfully kept by the Chinese, though it was known to hundreds of millions of the vast empire's population.

When Alexander the Great swept with his victorious Greeks through Asia into India, about 330 B.C., he carried back with him to the Mediterranean lands the first raw silk that Europe had ever seen But he did not get the most important thing of all, the secret of the silkworms, which remained locked in the strange old walled country of China until 300 years after the Christian era. Then it was carried to Japan by four Chinese maidens, kidnapped by the Japanese from a silk-weaving village. At about the same time a Chinese princess, who had married an Indian prince, is said to have carried silkworm eggs hidden in her headdress to her new home, and taught her new subjects this valuable art.

AFTER THE SPINNING IS DONE

These little spinners have finished their spinning and the silk dresses they have made for themselves will soon be converted into dresses for other people. The upper picture shows a group of silkworm cocoons in their nests on branches of brushwood laid in racks like those of the picture below. The Japanese girls are removing finished cocoons.

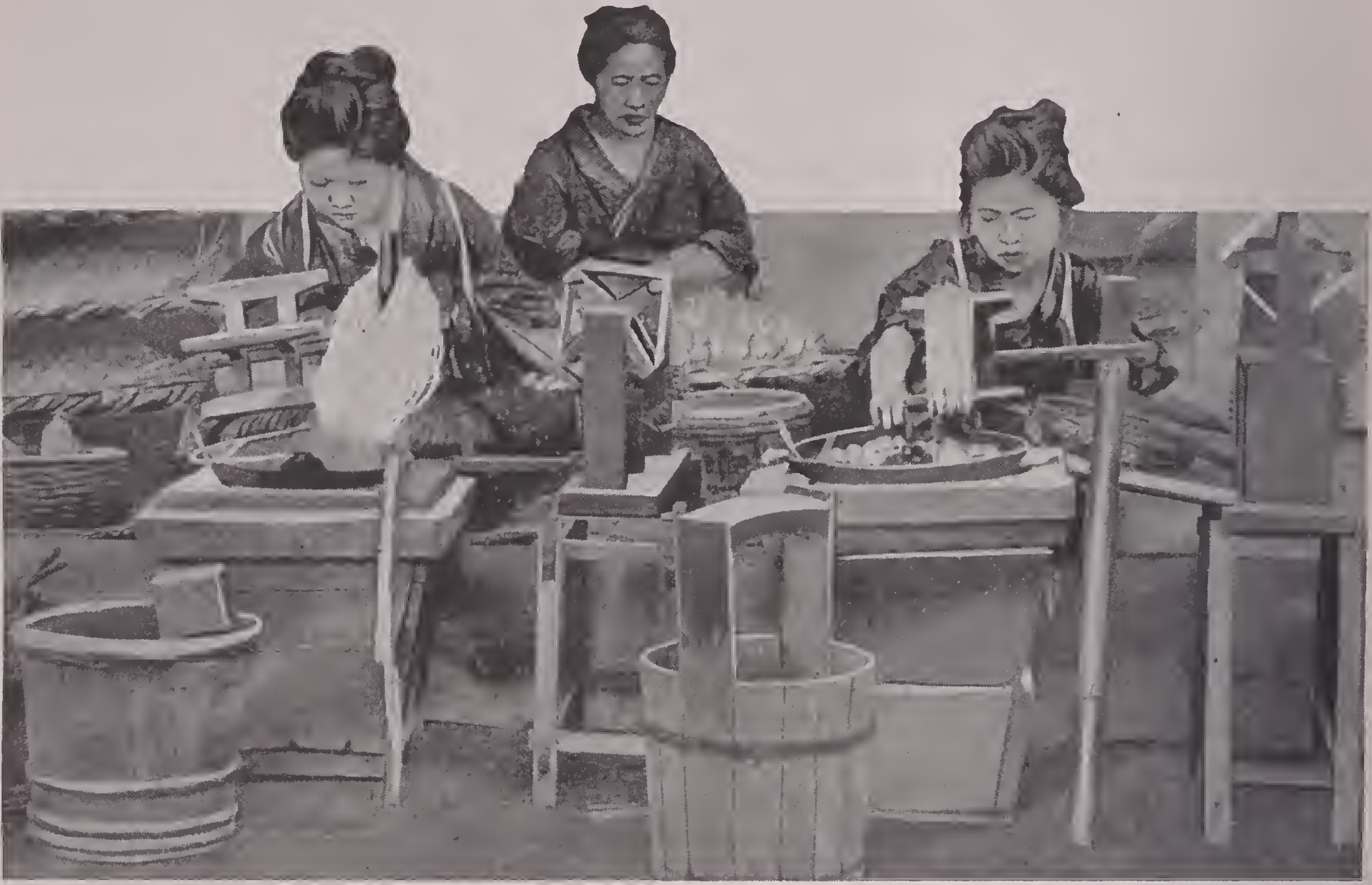
But the knowledge of silkworm culture spread very slowly, and as late as 550 A.D. all the silk in the Roman Empire was brought by caravan over dangerous overland routes from Persia and India, which made it so expensive that it was an extravagance even for emperors. Not until Justinian's reign (527–565) were the first silkworms brought to Constantinople. Two Persian monks who had lived in China were induced by the emperor to go back to that land and try to procure some of the silkworm eggs. If their purpose had been discovered they would certainly have been killed, but they returned safely with the precious eggs concealed in their hollow pilgrim's staffs, and from those eggs were produced the silkworms which supplied the western world for 1,200 years.

The new industry spread slowly from Constantinople. Under the conquering Saracens it was carried both east and west. Sicily became one of the homes of silk cultivation and manufacture, and the art spread next to Florence, Milan, Venice, and Genoa, all of which became famous for their beautiful fabrics. Silk manufacture began in France as early as the 13th century, but the production of cocoons was not successfully begun until the close of the 15th. About the same time England began to manufacture fabrics from imported silk skeins, but all attempts to breed silkworms there have failed. After 1685, when the Edict of Nantes was revoked, 400,000 Huguenots, who were especially skilled in weaving silk, fled from France to England, Switzerland, and Germany, and gave tremendous impetus to the growth of the industry in these countries.

All attempts to introduce silkworm culture into the United States have failed, although far more silk is manufactured and used there than in any other country. About 1838 a variety of mulberry tree, which was said to be adapted to culture in the United States was extensively introduced, but growers soon found that the trees were not hardy enough to withstand the northern climate, and a fatal blight in 1844 completed the downfall of the industry. (*See* Mulberry.)

It is now realized that the culture of raw silk can be profitably undertaken only where there is an abundant supply of cheap labor, since the care of the worms and the preparation of the raw silk requires much patient attention. Today raw silk is produced in considerable quantities only in China, Japan, India, France, Italy, Persia, and Turkey. Bengal is one of the ideal silk-raising districts of the world, for the climate there permits of three crops of cocoons a year—one in March, one in July, and one in November. Some of the other countries have two crops, others only one.

THE REELING OF THE SILK



After the cocoons have been gathered and the young worms have been killed by dry heat or steam, they are sorted according to color, size, and quality. Then the delicate threads from several cocoons are unwound and laid together so as to make a single strand and these strands are wound on reels. In the small communities of Japan, reeling is done as you see it here, but silk reeled in this way is apt to be uneven and lumpy. The best silk is reeled in large factories by machinery.

OPENING A BALE OF SILK

The reels of silk are shipped in bales with matting covers. This bale is being opened at a silk mill at South Manchester, Connecticut.

Though Asiatic countries grow the bulk of the world's silk, they manufacture little more than they use themselves. The western nations, with their improved machinery, are able to manufacture more cheaply. The silk-weaving industry in the United States is comparatively young, having grown up almost entirely since the Civil War. Between 1899 and 1914, the value of its products more than trebled. The manufacture flourishes chiefly in the eastern states, especially in New Jersey, Pennsylvania, New York, and Connecticut. Other important manufacturing countries are France, Germany, Switzerland, Italy, Russia, and Great Britain. The workers are usually women, and in Pennsylvania and some other states they are often the wives and daughters of workers in the coal mines.

The wonderful little silkworm that makes all the world's silk is hatched from a tiny egg about the size of a pin's head. In the early summer the mother moth lays from 200 to 500 of these eggs on strips of paper or muslin prepared for her. They are kept in a cool dark place, and in the spring are put into trays and hatched by artificial heat. When the young worms or larvae emerge from the eggs they are little dark wriggling creatures about a quarter of an inch long. They have prodigious appetites, and soon they are eating their own weight in mulberry leaves every day. They grow so fat that they shed their skins four times before they are full grown. It takes about a ton of leaves to raise from 30,000 to 35,000 of the worms.

In four to six weeks the worms have become plump, grayish-white caterpillars, about 2½ inches long, and they are ready to spin their cocoons. They then climb up the brushwood branches or the many-celled racks prepared for them, and begin the work for which they

WHEN THE SILK GETS TO MILL

After the silk has been washed, it is straightened, as in the top picture. In the center you see a twisting machine at work. The third picture shows a row of spinning machines.

have been so carefully reared. On both sides of their bodies are glands which have become filled with thick glue-like material. The worms now press this out in two slender threads which stick together as they emerge from an opening in the upper lip, called the "spinneret." The fluid threads at once harden in the air into the tough silk fiber, and the larvae weave them into cocoons completely surrounding their bodies, by bending their heads forward and backward in a figure-eight loop, presenting a most comical aspect at the task. In three or four days the cocoons are completed. In shape and size they are somewhat like pigeons' eggs and each contains from 500 to 1,200 yards of continuous thread.

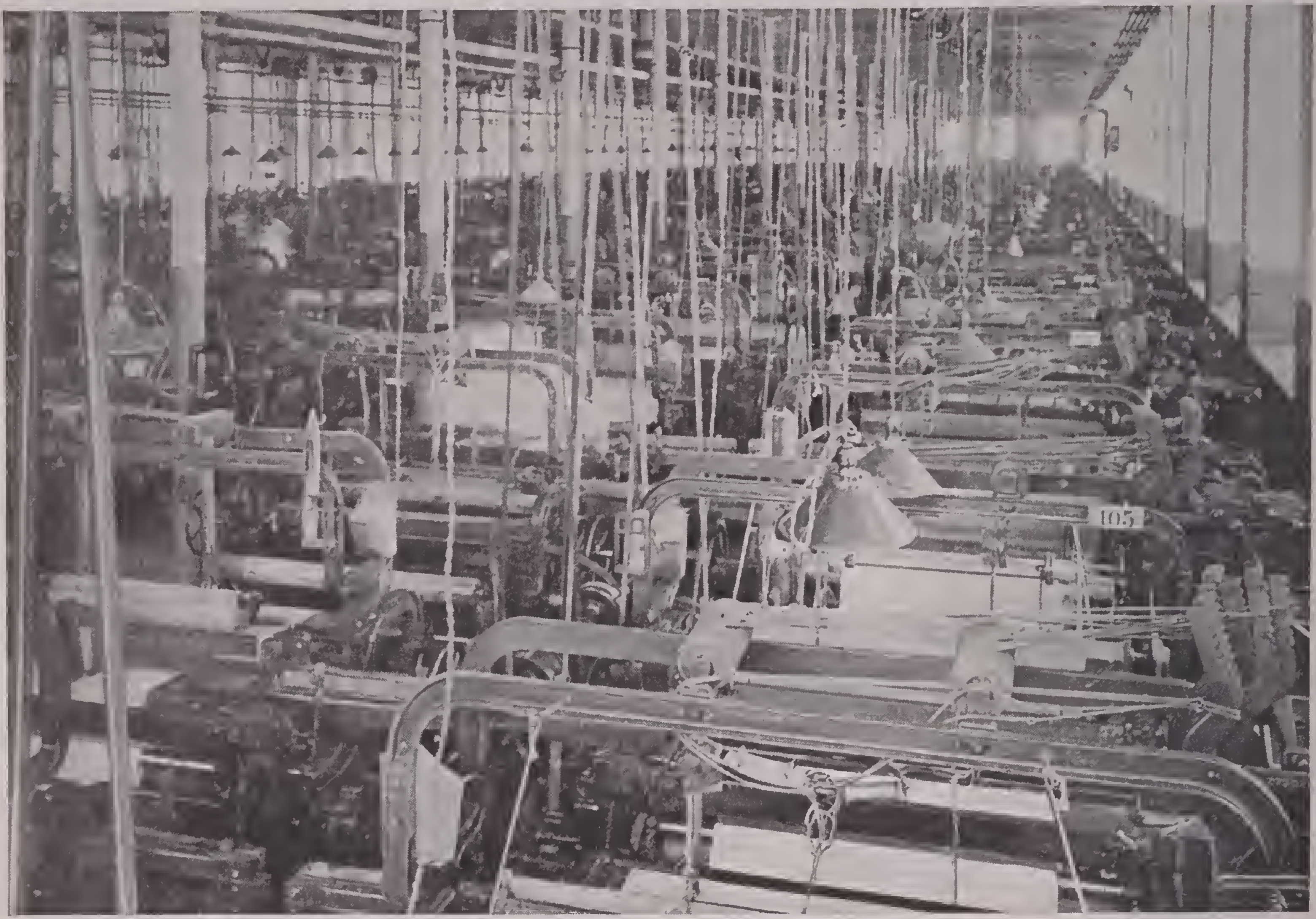
Usually the cocoons woven by domesticated silkworms in the Orient are white or light yellow, but nearly all the cocoons woven in western countries are yellow. In some parts of the Far East the cocoons of other insects akin to the silkworm are used to a certain extent, but their cocoons are not so good as those of the domesticated silkworm. These "wild silks"—the commonest and best of which is called *tussur* silk because it comes from the tussur worm—are usually écru or pale green in color. Familiar examples of these fabrics are pongee, rajah, and shantung silks. The coloring matter in wild silks cannot be removed by boiling, as in the silks of the domesticated insects, so the wild silks will take only the darker dyes.

Cast-off Silks Made as Good as New!

Two or three days after the cocoons are completed they are gathered and sorted. A few of the best are put aside in a warm place and carefully guarded until the developed moths bore their way out, to lay eggs for next season's brood of worms. The rest of the cocoons are put in a hot oven, or exposed to the sun's rays under glass, to kill off the worms within before they start breaking out of the cocoons and ruin them.

The next step is the exceedingly

THE BUSY FINGERS THAT WEAVE OUR SHIMMERING FABRICS



This shows the interior of a silk weaving mill. The "warp" threads—those which run lengthwise of the fabric—are first attached to a beam side by side. The beam is then placed in the back of the loom and the warp is unwound from this, each thread passing through an eyelet. As the machine revolves the warp threads are constantly lifted and lowered, and in the opening made by this rise and fall the shuttle carrying the "weft" thread flies across the warp.

delicate and laborious process of removing the fiber from the cocoons. First they are soaked for a few minutes in hot water to soften the gummy coat, while a girl with a small twig brush constantly stirs them. The outside of the cocoons is a coarse flossy covering of loose fibers, which adheres to the twigs and is so removed. Then the cocoons are put into trays filled with warm water, and the ends of several of the long threads are brought together and passed through a tiny guide like the eye of a needle. The fibers stick together to form a single strand and are wound upon a reel.

When the reel is full the silk is taken off in large hanks, and this is the form in which most raw silk reaches the United States. It takes from 130 to 140 pounds of cocoons to yield 12 pounds of raw silk, and the fastest workers can reel only a pound or two a day.

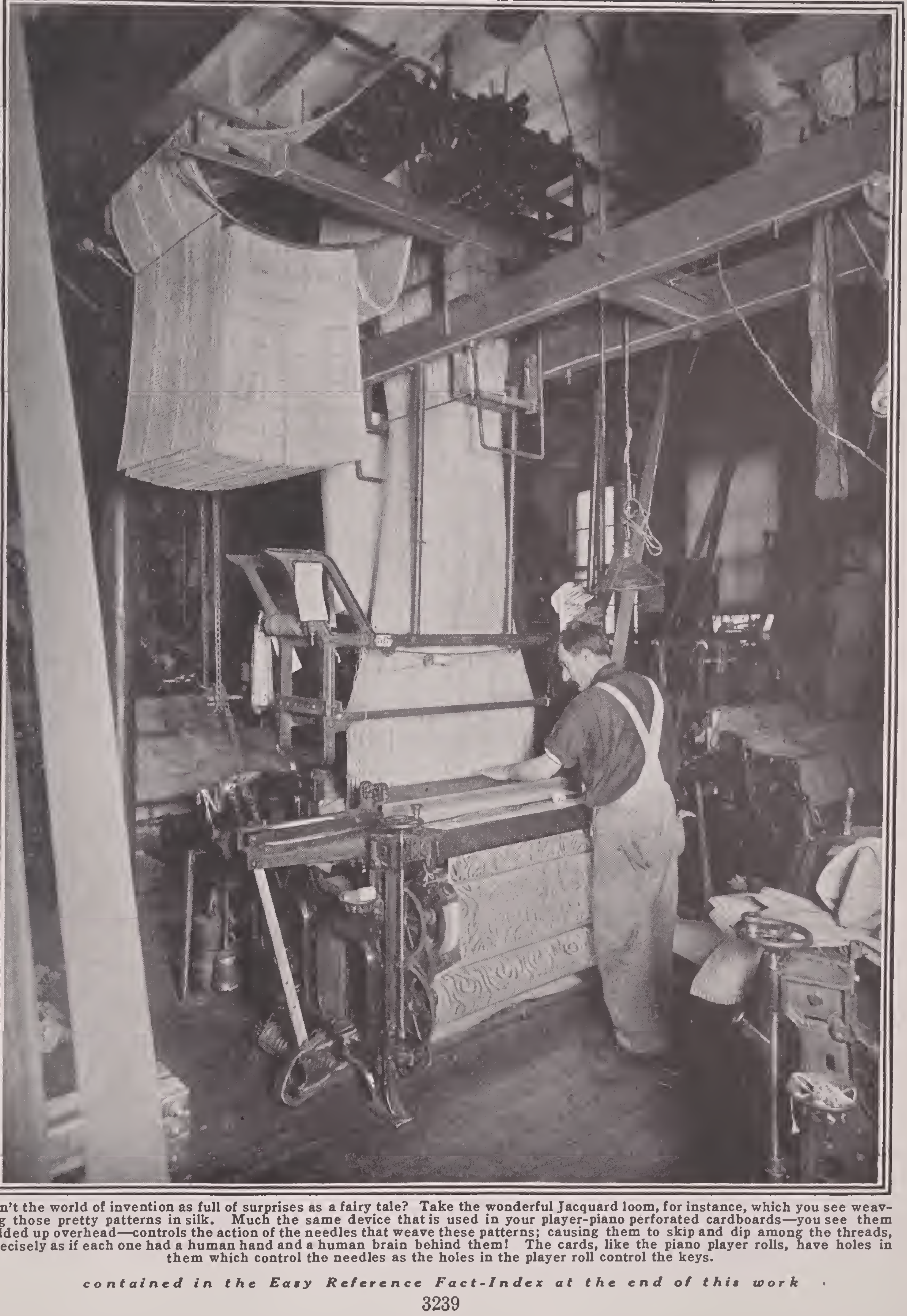
In many places the reeling is done by machinery, which not only increases the speed but also produces more even threads.

Before the silk is ready to be woven on the loom, it must go through the process known as "throwing." In this operation several threads are twisted and doubled into a more substantial yarn, while any thick lumps or imperfections are removed. One pound of good quality raw silk will yield enough unspun thread to reach from Philadelphia to New York and back—a distance of 181 miles. "Tram" silk, used for the woof in weaving, consists of two or more threads twisted together. To make "organzine," which is used for the warp of heavy fabrics, the threads are double-twisted. This is done on machines which twist the threads about 16 turns to the inch in one direction, then double it and twist it about 14 turns the other way. To convert a single pound of raw silk into organzine requires 264,000,000 revolutions of a spindle, so it is easy to understand why the throwing is not done in the Asiatic countries where the machinery is crude.

Silk Dresses that are Half Tin!

The yarn must now be scoured or degummed to remove the gummy coating and coloring matter, by steaming or boiling in soapy water. This robs the silk of about one-fifth of its weight—a serious loss where raw silk has sometimes cost more than $5 a pound. To make up for this shrinkage it is the common practice to "weight" the silk threads by putting them in a bath of tin dissolved in hydrochloric acid. By alternating this bath with another containing phosphate of soda, it is possible to continue the

"MUSIC" CARDS THAT PLAY IN PATTERNS



Isn't the world of invention as full of surprises as a fairy tale? Take the wonderful Jacquard loom, for instance, which you see weaving those pretty patterns in silk. Much the same device that is used in your player-piano perforated cardboards—you see them folded up overhead—controls the action of the needles that weave these patterns; causing them to skip and dip among the threads, precisely as if each one had a human hand and a human brain behind them! The cards, like the piano player rolls, have holes in them which control the needles as the holes in the player roll control the keys.

process until a pound of raw silk, which shrunk to 13 ounces when it was degummed, has taken on enough tin to weigh from 20 to 60 ounces! Some silk fabrics are thus more than half tin. This weighting lessens the durability of the fabrics, and makes them harsh and crisp so that they crack where they are folded; but it greatly reduces the cost, and it is most used in the cheaper silks.

After the silk has gone through these processes, and has been bleached (if for white fabrics) or dyed (if for colored fabrics), it is ready for weaving (*see* Spinning and Weaving). Waste silk, that is the "floss" silk from the outside of the cocoons, and the large proportion—about three-tenths—of the inside of the cocoons that cannot be unwound, is treated much like wool, and is spun into threads called "spun" silk. This is used for silk yarns and for making fabrics of less durability than true silk.

Almost one-half the silk manufactured in the United States is used for dress goods. A garment of pure silk lasts a very long time, for there is hardly any material that wears better. The silk from worms fed on the ailanthus tree wears better than from the worms fed on the mulberry tree, but it is not so soft and glossy. Silk velvets, ribbons, hose, silk fringe, embroidery silks, silk yarns and threads, and beautiful upholstery fabrics are also important branches of the silk manufacturing industry.

Use of Silk in War and Industry

But silk is not merely a soft creation of the boudoir and the drawing room. The sturdy side of this lovely fabric comes to the front in the grim days of war. Then great observation balloons made of silk soar above the battlefields; tiny silken parachutes uphold the dazzling "star-shells" that float over No-Man's Land at night to guard against surprise attacks; and powder charges for some types of guns and trench mortars are contained in bags of silk. Silk is also used for many purposes in industry—for example, in the "bolting cloths" used in sifting flour.

Artificial silk, usually called "fiber silk," is a fabric entirely different from pure silk, but it possesses a silken luster. Indeed, artificial silk may be the more lustrous of the two, but it has a very different feel. It is made by the action of various chemicals on cotton or wood-pulp, which forms collodion (*see* Collodion). This is then forced between rollers, next through tubes into diluted nitric acid, where the minute streams of collodion are converted into fibers. These fibers are then wound on reels and dried, and subjected to a variety of washing and drying processes, until they are ready to be spun. Since fiber silk is usually not weighted with tin it is more durable than most real silk, and quality for quality it is cheaper. It is much used for hosiery and the beautiful knit fabric called tricolette.

Scientific name of silkworm moth, *Bombyx mori*. It belongs to the *Bombycidae* family of the moths. The body is about half an inch long, and the outspread wings measure about two inches from tip to tip. The domesticated silkworm has been so weakened by the artificial life to which it has been subjected that it has been robbed of its natural strength and has become subject to many serious diseases. Hundreds of bacteriologists are kept busy studying the microbes that prey upon this little animal and seeking means to combat them.

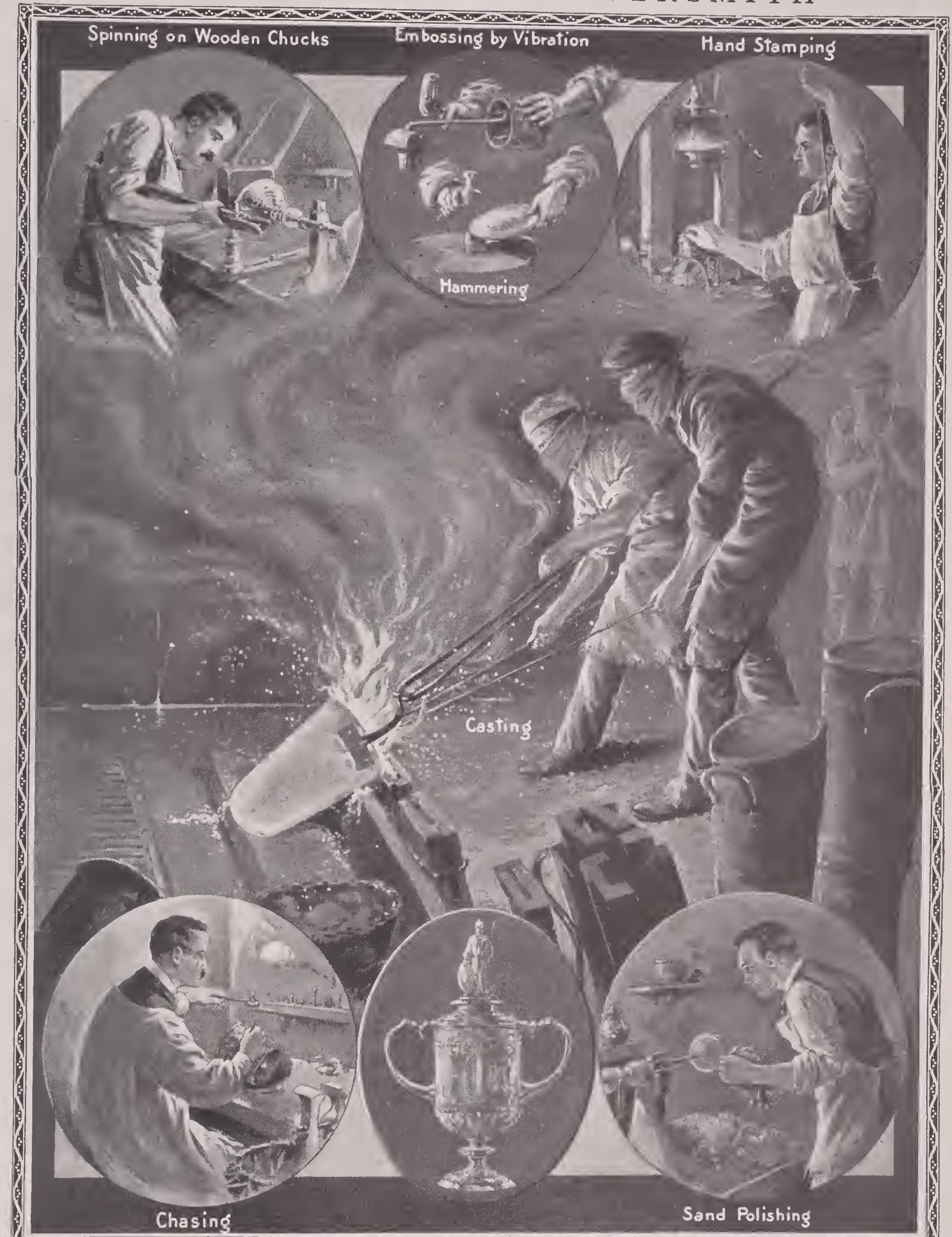
SILOS. Storing green crops in a silo is like bottling up a pasture for use during the winter months or for use all the year around to take the place of pasture land partly or entirely. Nearly every well-equipped farm has one or more of these tall cylindrical structures in which to store up fresh juicy foods for the stock, much as fresh fruits and vegetables are canned for human use. Dried grains and fodder unmixed with green foods are not only expensive for feeding stock, but are so unsatisfactory for milch cows that it was common practice to allow them to go dry during the winter months. The ensilage or silage, as the contents of the silo is called, rivals the pastures of June in providing the succulent foods so necessary for the dairy herd, as well as other farm stock, and it is especially useful in promoting the healthy growth of young animals.

Corn, which is the principal silage crop, is cut before the juices of the green plants begin to dry out in the fall. The entire plant—stalk, leaves, and ears—is chopped into short lengths by machinery so that it will pack readily, and put directly into the silo. If the corn is too dry, water is poured over it as it is packed away. It is estimated that food equivalent to four tons of hay can be produced ordinarily from one acre of corn. This makes corn preserved in a silo a very economical crop, especially as it is so compactly and economically stored. Clover, oats, rye, sorghum, alfalfa, cow peas, beans, millets, and wheat may also be used as silage when cut green. Recent experiments with sunflowers for silage have been very successful, the yield being twice that of corn. Green material closely packed in an air-tight silo will keep in good condition for many months. Although some chemical changes take place, the composition and feeding value of silage is practically the same as that of the green plants.

The silo, which has brought about some of the most important changes in modern agriculture, was introduced into America from Europe about 1875. The first silos were pits dug in the ground into which the crops were packed and covered over with straw and sod. The modern silo is above ground and is built of wood, brick, stone, or concrete. Concrete is favored in most localities because it is durable, air-tight, water-proof, and vermin-proof. Practically all silos are built in cylindrical form, leaving no corners where air spaces may cause the spoiling of the silage. They are made tall with small surface area so that the silage may be used from the top fast enough to keep the surface from spoiling.

SILVER. Late in the spring of 1859 two grizzled miners were busy with pickax and shovel in the barren wilderness near where Virginia City, Nev., stands today. They were digging a reservoir to collect water for their crude mining operations. For months

THE ART OF THE SILVERSMITH



These pictures tell the story of that silver cup at the bottom. The figure on the cover is cast in the mold the masked workmen are pulling from the furnace. The rest is modeled by hand. First a silver sheet is fixed around a wooden form or "chuck." This revolves in a lathe while the circular designs are pressed in with steel tools. The embossed portions are tapped out by a steel mallet set vibrating in a vise. The cover rim is hammered out by hand, and certain other portions of the design are stamped by a press, or "chased," that is driven in with the blows of a punch. Last of all comes the polishing against a spinning wheel.

the gold dust they had been able to wash from the nearby gravel banks had scarcely provided a living.

At a depth of four feet one of the miners felt his pickax strike a hard substance, a heavy black dirt very different from the surrounding yellowish gravel and clay. Completely ignorant of the nature of the substance, they washed it in their "rockers." They were disappointed to find, instead of fine yellow gold, a much lighter-colored metal, barely tinged with a golden hue. Not long afterward they sold their discovery for a small sum, little realizing that it would turn out to be the world-renowned Comstock mine, one of the richest bodies of silver ore ever unearthed. The little strip of ground in which this famous orebody is situated produced in 30 years more than $300,000,000 worth of silver and gold. This tremendous production affected the value of silver and upset the money standards of the whole world.

Tragedy pursued the original discoverers of this huge deposit of wealth. One, Patrick McLaughlin, died in a few years so poor that he was buried in a pauper's grave. The other, Peter O'Riley, died insane, cherishing the belief that spirits were leading him on to the discovery of another "Comstock." H. T. P. Comstock, who had claimed the honor of the discovery, giving his name to it, killed himself ten years later after brooding over the fortune he had let slip through his hands.

Although the Comstock lode remains perhaps the most spectacular discovery of precious ores recorded, it is typical of scores of others. In fact, the entire history of gold and silver—for the two are commonly found together—is interspersed with a thread of romance, adventure, and exploration which makes it read like an 'Arabian Nights' tale. The story of Diego Hualca, a poor Indian hunter, is only one of many. While pursuing a goat up the side of a mountain in Peru, in the year 1545, he grasped a jutting bush for support. The bush came out, root and branch, in his hand, and revealed to his astonished eyes the surface outcroppings of the huge silver deposit known as the Potosi. Spanish adventurers extracted millions upon millions of dollars' worth of silver from these prodigiously rich ores.

And Silver Helped Cause the Carthaginian War!

Silver has been known and used by man since pre-historic times. It is mentioned in the Chinese classics, dating from 2500 B.C. Herodotus the Greek historian says: "So far as we know the Lydians were the first to make coins of gold and silver." The silver mines of Laurium, in Attica, are famous in Greek history; and those in Spain, of a later date, are even better known. In part it was Rome's jealousy of Carthage for the possession of these Spanish ore deposits that brought on the first Punic War and started Carthage toward her fall. The Greeks and Romans used a metal called "electrum," 20 per cent gold and 80 per cent silver, for wine goblets, because it was popularly believed to possess the property of betraying the presence of poison.

Silver is the most malleable of metals, with the exception of gold, and is next to platinum in ductility. One ounce of silver can be drawn out into a wire more than three miles long, and silver leaf can be beaten to a thickness of one ten-thousandth of an inch. Silver is the most perfect conductor of electricity known, but it is far too costly to be used extensively for this purpose. Silver melts at 1,000° Centigrade, and volatilizes or forms gas at higher temperatures. This gas is a pale blue vapor which absorbs large quantities of oxygen. As it cools and becomes solid again, it expels the oxygen with great violence—a curious phenomenon known as "spitting silver."

Use of Silver in the Industries

About one-third of the world's annual production of silver is made into coin; the remainder is used for industrial purposes. Silver is highly prized for toilet articles and jewelry throughout the world, and the profession of the silversmith has been an honored one for centuries. Many ornaments used in churches are of silver. In Europe and America table-ware is made of solid or plated silver. Silver forms useful alloys with almost all metals, but chiefly with gold and copper. It combines also most readily with sulphur, forming the black silver sulphide so often seen on spoons and forks which have been in contact with the yolks of eggs. Silver is the chief component of one of the most dangerous explosives known, called silver fulminate. When dry, this compound explodes with terrific violence, even on touching it with a feather.

Silver compounded with chlorine, and more often with bromine, forms those strange chemical salts which are sensitive to light and are therefore used in photography. The image in a photograph is composed of deposits of pure metallic silver in the gelatine coating. (*See* Photography.)

Various compounds of silver are used in medicine and surgery. The most important of these is silver nitrate or "lunar caustic," a powerful antiseptic with healing properties. Internally certain silver chemicals are used for gastric disorders and dysentery, but taken in large quantities they are dangerous poisons.

Wounds are sometimes sewed together with silver wire and broken bones bound with silver bands. Fractured parts of the skull sometimes are replaced with silver plates. This metal is also used extensively in the manufacture of surgical instruments.

Silver is mined principally in the United States, Mexico, South America, Germany, Austria, Canada, Spain, and Australia. It is often found associated with copper and lead, and much of the world's supply is obtained as a by-product in smelting these metals. Indeed, unless a rich deposit is found, the mining of silver for itself alone does not often prove profitable. The silver mines of Cobalt, Ontario, are relatively shallow. The ore here is perhaps the richest known in the world today, in places running as high as 200 pounds of pure silver to the ton. In the Cobalt region, much of the silver occurs in metallic form.

Nevada, Montana, Utah, and Idaho are the leading states in silver production in the United States. (*See also* Mines and Mining; Money.)

SIMS, VICE-ADMIRAL WILLIAM SOWDEN (born 1858). One fair morning in May 1917, soon after the United States entered the World War, the Stars and Stripes rose slowly to the top of a British mast, and for the first time in history a considerable portion of His Majesty's navy was under the command of an American officer. The man upon whom this unique distinction was bestowed was Vice-Admiral Sims. The occasion was an emergency in the Irish Sea which called for a combined fleet of British and American ships.

ADMIRAL SIMS

When the United States declared war against Germany, Sims, then Rear-Admiral and president of the Naval War College at Newport, was put in command of American naval operations in European waters. No one was better fitted to assume this huge task. When a young man, on duty in China, he met an English officer, Captain (later Rear-Admiral) Percy Scott, whose ship was making remarkable records at target practice by using a device of Scott's. After much study Sims became convinced that American gunnery was dangerously inefficient and he urged the adoption of the new methods upon the Navy Department. Getting no response from that quarter, he wrote directly to President Roosevelt. In reply he was ordered home, where he conclusively proved his contention. Entire charge of the navy's gunnery was assigned to him and seven years later American gunners were the most expert in the world. Then in 1907 he opened the nation's eyes to many grave faults in the design of American battleships. After a heated controversy the faults were eliminated in all subsequent ships, and thanks to this and to several new ideas evolved by the Navy Department, American dreadnoughts are among the best in the world.

And what would you guess is the favorite pastime of so distinguished a naval officer? It is writing limericks!

Admiral Sims was born in Port Hope, Canada, but his parents subsequently removed to the United States. He was educated in the United States Naval Academy at Annapolis (1876–80), to which he was appointed from Pennsylvania.

SINGAPORE (*sĭng-ȧ-pōr′*). Through the needle's eye of Malacca Strait is threaded the great trading route to the Far East, controlled at the tip of the Malay Peninsula by the island city of Singapore, midway between India and China. In Singapore harbor lie great and small ocean liners, long lines of Chinese coaling-ships, Malay sampans with split-tail sterns and painted eyes on the bow, and curious Chinese sailing craft—an aggregate shipping of 17,000,000 tons yearly. From some of the emerald islands sprinkled over the pale green sea stare bristling rows of big guns—for the "Liverpool of the East" is not only the chief commercial center of southern Asia and one of the most valuable of British minor possessions, but a naval base of great strategic importance in the Orient.

A splendid European hotel faces the sea; parks, clubs, and polo and cricket grounds reconcile European residents to the sultry climate of latitude 1° 20′ N.; but the narrow streets of the native quarter swarm with bobbing rickshaws, tall red-bearded Arabs, Bombay merchants, shrewd Chinamen, and "blacks" from the mainland. More than half of Singapore's population is Chinese, but there is scarcely a color, creed, caste, or nationality unrepresented in the cosmopolitan swarm. Red roads, on which all day long hungry-looking black Tamils sprinkle water from a pig-skin, gash the deep green of the thick shrubbery, luxuriant in the humid heat—for all seasons are wet in Singapore; there are 182 rainy days in an average year. The highest of the island's hills is called the Tin-hill, for Singapore lies in the region from which one-third of the world's tin comes, and tin-smelting is the chief industry in this busy tropical city.

Singapore island is 27 miles long by 14 broad. The town is the seat of government for the British crown colony known as the Straits Settlements. Population, more than 300,000.

SIPHON. If you fill a rubber tube with water, pinch the two ends to keep the water from escaping, put one end in a bucket of water on the table and the other in an empty bucket on the floor below, then release the ends, the water will flow up through the tube as it curves over the rim of the upper bucket and then down through the tube into the lower bucket. Such a contrivance is called a siphon.

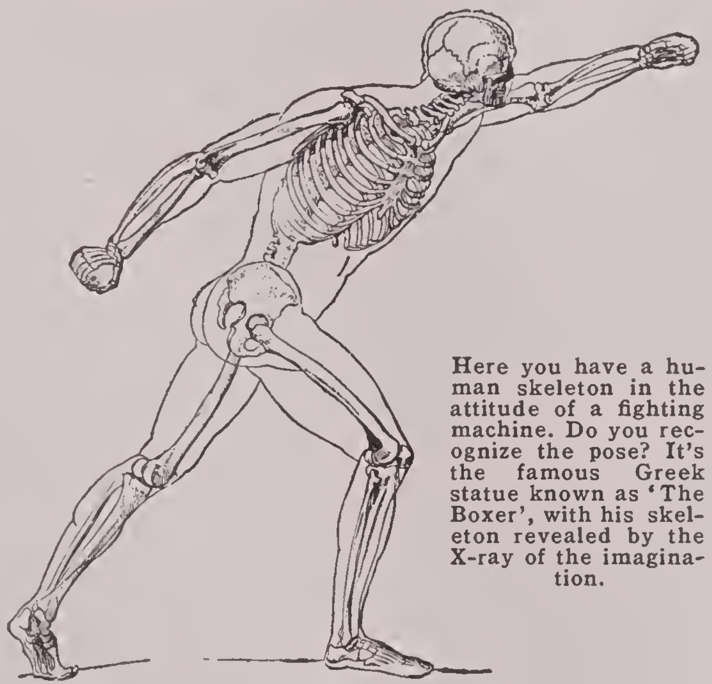
Gravity is pulling down on the water in both limbs of the tube, yet it flows up one side and down the other. Why? Atmospheric pressure does the trick—atmospheric pressure plus the difference in the weight of the two columns of water in the tube. When the water flows out of the lower end, atmospheric pressure on the water in the upper pail pushes it up to fill the vacuum that would otherwise occur at the top of the bend. The siphon will not raise water more than about 33 feet, because then the weight of the water equals the atmospheric pressure.

Siphons on a large scale are used in aqueducts to carry water across hills. The so-called "siphons" of charged water are not true siphons, for the water is forced out by the pressure of the gas.

SISAL (*sĭs′äl*). There is one time when every American farmer takes an interest in the internal affairs of Mexico and the Central American republics. That is when one of their frequent civil wars threatens to cut off the thousands of tons of sisal fiber that go into the binder twine for his grain crops. Yucatan is the original home of the sisal plant and the chief place where it is cultivated, although some of the supply now comes from other portions of Central America, Mexico, Hawaii, and West Indies.

The sisal plant is a perennial growing for a period of 8 to 25 years. The fiber is yellowish-white, lustrous, strong, and pliable, and among the cordage fibers it is only excelled by the long smooth fiber of Manila hemp. It is a relative of the century plant, which it closely resembles. The swordlike leaves, which spring straight and stiff from the base of the plant, are from three to five feet long and as wide and thick as a man's hand. They are not ready to cut until about the fifth year of their growth, and then only the bottom rows of mature leaves are cut each year. About 12 to 20 leaves are taken from a plant at one cutting, to furnish about a pound of fiber. The leaves are cut with a sharp knife, tied in bundles, and hauled to a central plant where machines crush and pound them and scrape away the pulp. The clean fiber is taken from the machine and hung up to dry, after which it is baled for shipment.

THE MARVELOUS FRAMEWORK OF THE BODY



Here you have a human skeleton in the attitude of a fighting machine. Do you recognize the pose? It's the famous Greek statue known as 'The Boxer', with his skeleton revealed by the X-ray of the imagination.

At maturity the sisal plant sends up a flower stalk, 10 to 20 feet high, bearing dense flower clusters on a branching head. The flowers are followed by small plants or bulbils, instead of seeds, which are cast on the ground to propagate new plants, and then the parent plant dies. Fresh sprouts start from the dead stem of the old plant and new plantations are obtained by setting out either the sprouts or the bulbils.

The sisal plant requires a continuous warm dry climate, and is injured by frost. It needs little care except for the cutting down of vegetation between the plant rows once or twice a year. Henequen is another name for the sisal plant, and the chief varieties are *Agave fourcroydes* and *Agave sisalana*.

SISYPHUS (*sĭs′ĭ-fŭs*). For his craft and exceeding wickedness, Sisyphus, founder and king of Corinth, was doomed, according to Greek legend, to one of the bitterest punishments of the lower world. He was condemned to roll a large stone up a hill which, when it reached the top, fell over back again, so that his wearying task was never ended. Dante in his great poem, the 'Inferno', represents Sisyphus toiling ceaselessly throughout the ages at his hopeless task.

SKATES OR RAYS. Thirty or more varieties of these strange fishes are found in the Atlantic and Pacific oceans, each variety more villainous in appearance than the next. They are quite properly called "sea-devils," for they look more like monsters seen in a nightmare than proper inhabitants of the sea. They are close relatives of the sharks, though so different in shape and appearance. All species of skates are more or less flat and triangular in shape, with a long thin tail, often equipped with a barbed spine, with which they can inflict painful and sometimes dangerous wounds. Their peculiar shape is due to the expansion of their front fins into broad flaps of flesh, with which they make their way awkwardly through the water. Some "sea-devils" are enormous, reaching 15 feet in width, and weighing 1,000 pounds.

Skates usually live on the sandy bottom of the ocean not far from shore. Their eggs have an oblong tough shell from three to eight inches long, with a streamer at each corner.

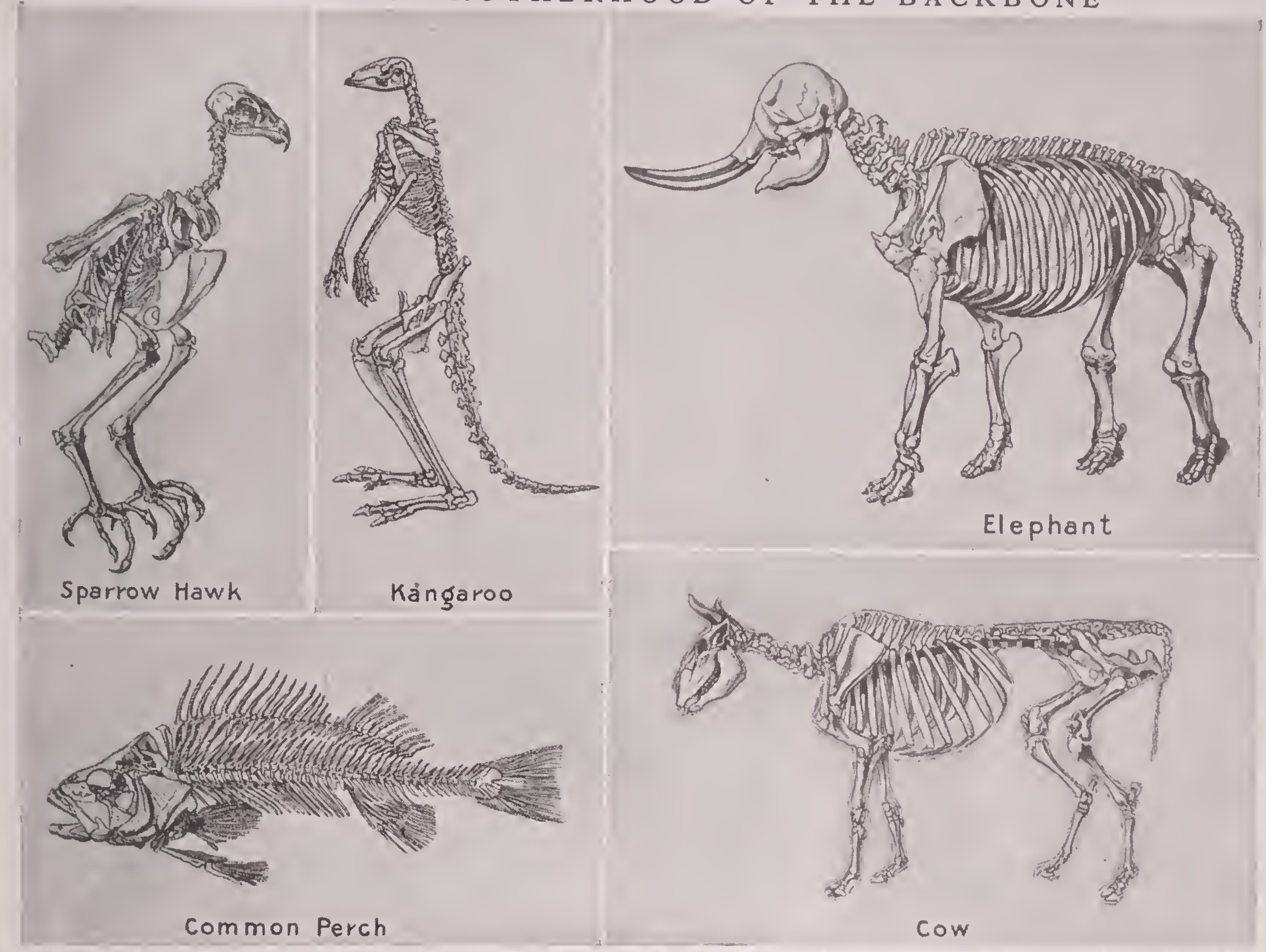
Scientific name of common skate, *Raia batis;* of sting-ray, *Myliobatis californicus.*

SKELETON. When we build an engine we always start with a rigid framework to which the moving parts are fastened. The more powerful we make our engine, the stronger and more solid must be the foundation. It is the same with the living engines of the animal world. They need a framework to support their lung-carburetors, their heart-valves, and their stomach-cylinders; and they must have a foundation from which their arm-pistons and walking-beams can be thrust out. This framework and foundation is called the "skeleton."

Some animals, like the lobster and the crab, the oyster and the beetle, wear their skeletons on the outside. Water creatures, as a rule, don't need such a strong framework, for they are surrounded and supported on all sides by the water in which they live. Some, like the octopus and cuttlefish, get along with nothing but one gristly or chalky bone, but they are usually slow and helpless on land.

In fact, so essential is the skeleton to active versatile life that the higher forms of animals are classified as *vertebrates*—that is, creatures with backbones. Of these, man is the highest, and has, therefore, the most highly developed skeleton.

THE GREAT BROTHERHOOD OF THE BACKBONE



"Nature," says Emerson, "plays one tune to infinite variations." Here we see illustrations of the many "tunes" that she has played on the idea of the backbone. To the backbone of the Sparrow Hawk she attached wings and so made a bird of the air. In the picture of the Kangaroo, note the relative size of the front and hind legs. Even if we had never seen a Kangaroo, the skeleton would tell us that it did not walk on all fours. The Elephant and the Cow have a somewhat similar anatomy, since they are both mammals, and a similar cumbrous dragging gait. But the Perch might say: "We fish are the grandfathers of them all"; for Nature's great discovery of the backbone was made in the life of the water.

The human skeleton is composed of about 200 bones, each adapted to its place and duty. The foundation of our body structure is the "backbone" or spinal column, which is really composed of 24 separate bones called "vertebrae." There is a pad of cartilage between each two vertebrae, forming an elastic cushion and permitting a slight motion. The skull is set on top of the vertebral column. About 20 bones form the skull, there being more in early life than later, some of the parts uniting gradually as life advances. Twenty-four ribs, 12 on each side, bound the chest; most of these are connected by cartilage to the breastbone. The "shoulder girdle," consisting of the shoulder-blade and collar-bone, supports the arm. At the lower end of the backbone is the "pelvis," a strong bony ring composed in the young of six separate bones, but later uniting to form only two. To the pelvis the legs are attached.

The bones of the skeleton are held together by strong bands of connective tissue called ligaments. It is the tearing out of ligaments that constitutes the essential injury of a bad sprain.

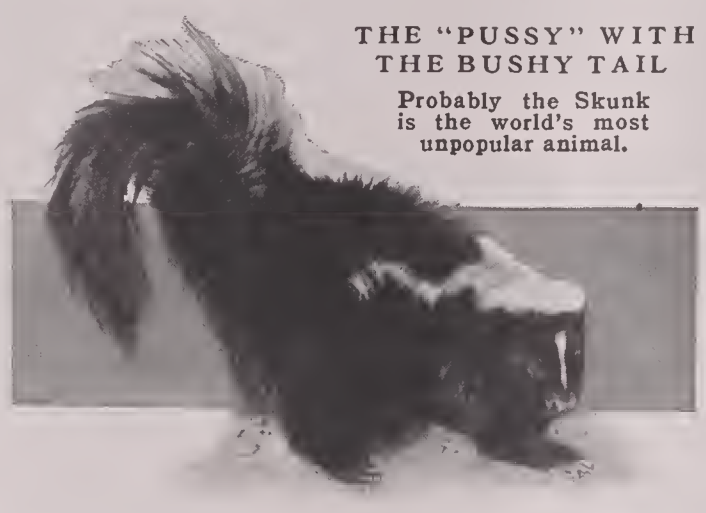
The skeleton made up of its separate bones with their numerous hinges or joints, their cartilaginous cushions, and their tough ligaments constitutes a wonderfully adjustable, elastic, strong, and protective foundation for all the organs. The muscles in large part are attached to the bones across the joints, so that movements are brought about by the shortening or contraction of the muscles. The vital organs are well protected in bony cavities like the cranium, chest, and pelvis.

In the young the number of bones is larger, the proportion of cartilage greater, and the percentage of mineral matter less. Hence they can stand falls and bumps that would be likely to break the bones of an old person.

SKIN. Human skin is composed of two main layers, the "epidermis" or scarf skin outside, and the "dermis" or true skin underneath. The true skin is studded and ridged with tiny projections above; the scarf skin is correspondingly pitted and furrowed underneath; and the two fit together like the parts of a puzzle. On the palms of the hand and the soles of the feet these ridges become so prominent that the upper surface of the epidermis is ridged and furrowed in patterns of tiny whorls and loops which are unique for each individual, so that each person's finger-print is an authentic "sign-manual," better than any written signature (*see* Finger-Prints).

We speak of "thick-skinned" and "thin-skinned" people, but all of us are comparatively thin-skinned over certain parts of the body (about 0.5 of a millimeter or $\frac{1}{50}$ of an inch on the eyelids, for instance), and thick-skinned over others (4 millimeters—about $\frac{1}{16}$ of an inch—or more over the palms and soles). The skin is thicker over the back than in front, and on the outer than on the inner sides of limbs.

The outer layers of the epidermis are constantly drying up, flaking off, and being renewed from below—imperceptibly as a rule, though we notice the loss and replacement when the skin is blistered or otherwise injured. The deeper epidermis layers contain the pigment that makes an Indian brownish-red, a Chinese yellow, and a negro black. The pink of a fair or florid complexion is due to the red blood circulating under a more or less colorless and translucent skin. Finger-nails and toe-nails, like the claws and hoofs of the lower animals, and the hollow horns of the ruminants, are merely thickened and hardened epidermis. Hair, too, is modified epidermis (*see* Hair).



THE "PUSSY" WITH THE BUSHY TAIL

Probably the Skunk is the world's most unpopular animal.

Two sets of glands pour their secretions over the skin. The flask-shaped sebaceous glands, situated deep in the true skin and usually associated with the hairs, occur practically all over the body except on the palms and soles. In health their oily semifluid secretion lubricates the skin and hair. Sometimes it hardens within the duct, forming a plug or "blackhead" which has to be pressed out. The sweat glands are set deeper yet and reach the surface through crooked ducts, twisted like a corkscrew where the outer epidermis is thick and horny. They are scattered all over the body, being most numerous in the places from which the sebaceous glands are absent, the palms and soles. There are estimated to be nearly 3,000 sweat glands to the square inch in the palms—more than six times as many as in the skin of the back. Their secretion, the perspiration, is essentially water.

The skin serves a threefold purpose: (1) Tough, resistant, flexible, and elastic, it protects the delicate body tissues against injuries, being especially thick, hard, and cushioned with fat where it is subject to constant knocks and pressure, as on the soles, and more delicate and elastic over the joints. (2) Much news of the outside world reaches us in the form of sensations of touch, heat and cold, pain, etc., through the special sense organs in the skin. Many of the tiny protuberances (called "papillae") on the upper surface of the dermis contain nerve-endings; these "tactile papillae" are especially numerous over the soles and palms. (*See* Touch.) (3) Perhaps the most important function of the skin is the regulation of the body temperature. It keeps in the body heat, and also, when necessary, reduces the temperature through the evaporation of the perspiration. In summer the sweat glands are more active than in winter, so as to keep the body temperature normal in a heated atmosphere. The quantity of water thrown off by the skin depends also on the amount of water taken into the body and the physical exercise taken.

Baths, generally speaking, improve the condition of the skin, aid the action of the glands, and reduce heat.

SKUNK. Many a story is told of persons who have ignorantly or carelessly disturbed one of the "pretty pussies" and then have had to "bury their clothes" to get rid of the horrible odor! There are several species, all found only in the New World. The common skunk is about the size of a small cat, and ranges from Hudson Bay to Guatemala. The body is rather stout, the tail very bushy, and the prevailing colors black and white. It usually is black, with broad stripes of white running lengthwise.

Skunks burrow and are most active at night. They feed on insects, mice, salamanders, frogs, and eggs of birds that nest low. Sometimes they rob hens' nests, but this is by no means the rule. On the other hand, they benefit the farmer by destroying a large number of beetles, grasshoppers, and field mice.

Ordinarily they do not run at the approach of man, but, conscious of the protection of their evil-smelling secretion, move away deliberately. They can eject this fluid at will to a distance of 8 or 12 feet. Daring persons sometimes succeed in taming them so that they may be stroked and petted without ill results. Skunks often come close to camps and outlying dwellings, and a pair may even take up their abode under barn or porch. The flesh is said to be white and sweet. The fur of the skunk is now extensively used and is quite valuable. It sometimes goes under the name of "Alaska sable." Special treatment relieves the fur of all unpleasant odor.

The term "polecat," which is sometimes applied to the skunk, really belongs to a related animal of Europe and Asia, whose fur is dark brown above and black below.

Scientific name of the common skunk, *Mephitis mephitica;* of the European polecat, *Putorius foetidus.* Both names refer to the sickening odor.

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

SLANDER

"To speak no slander; no, nor listen to it," was one of the rules of King Arthur's Round Table. It is one of the rules of every gentleman and every gentlewoman; it is one of the rules of every good American.

"Thou shalt not bear false witness" is a solemn command which has come thundering down almost from the dawn of civilization. Slander is false witness. Today, when every man is truly your neighbor, when news travels on the wings of the lightning, that command means even more than it did in those days of old when first it was written on the tablets of stone.

The idea that slander is a poison is as old as literature. Juvenal called it "that worst of all poisons," and St. Bernard wrote:

> Slander is a poison which extinguishes charity, both in the slanderer and in the person who listens to it; so that a single calumny may prove fatal to an infinite number of souls, since it kills not only those who circulate it, but also those who do not reject it.

It was in the same spirit that Shakespeare wrote his stinging lines:

> 'Tis slander
> Whose edge is sharper than the sword, whose tongue
> Outvenoms all the worms of Nile, whose breath
> Rides on the posting winds, and doth belie
> All corners of the world.

It is a theft as well as a poison, for it robs people of their highest treasure—their good reputation. Desdemona says to Othello:

> Good name in man or woman, dear my lord,
> Is the immediate jewel of their souls;
> Who steals my purse steals trash; 'tis something, nothing; 'twas mine, 'tis his, and has been slave to thousands;
> But he that filches from me my good name
> Robs me of that which not enriches him
> And makes me poor indeed.

More often than not the slander that injures a man, and may bring about his ruin, begins in gossip, the gossip that comes, perhaps, from nothing worse at first than idleness. It is one of the greatest evils in the world, but it springs, as a rule, from ignorance.

We find it chiefly among those who have very little to do, and have no particular object in life, the sort of people of whom the old poet was thinking when he wrote:

> I slept beneath the moon,
> I basked beneath the sun,
> I lived a life of going-to-do,
> And died with nothing done.

CALUMNY

A whisper woke the air,
A soft, light tone, and low,
Yet barbed with shame and woe.
Ah! might it only perish there,
Nor further go.

But no! a quick and eager ear
Caught up the little, meaning sound;
Another voice has breathed it clear,
And so it wandered round
From ear to lip, from lip to ear,
Until it reached a gentle heart
That throbbed from all the world apart
And that—it broke.

It was the only heart it found—
The only heart 'twas meant to find,
When first its accents woke.
It reached that gentle heart at last,
And that—it broke!

FRANCES SARGENT OSGOOD

We may be sure that people to whom these lines apply are great gossips. They will talk about anything, but generally about things of which they know nothing. They will talk from morning to night, at street corners, and on doorsteps, in a shop or in a drawing-room. Many a man and woman they have ruined with their talk; for, nonsense though it mostly is, the strength that can ignore it is not common. The strong man can laugh at all the silly talk of silly people; but even he may be brought down by it at last, ruined in business, or driven from public life, or shunned by a world which is too busy to inquire, but shrugs its shoulders and whispers that "there must be something in it, or people would not say these things."

The danger of exaggerated talk besets us all. It is so easy to add a little to something we have heard, and a little added here and a little added there will turn harmless gossip into cruel slander, and truth into a lie.

We must be honest in things that we repeat, and careful in all that we say. If our own eyes and ears deceive us at times, as we know they do, we may be sure that truth loses much in coming through a dozen eyes and ears. If a thing sounds false, let us believe it false until we find it true, and let us think good of all until we find them unworthy.

SLANG. There is a "vagabond language"—wild, free, racy, often vulgar—which refuses to follow the usual standards established by the best writers and speakers. We call it slang.

At its worst the use of slang tends to vulgarize one's speech, to limit one's vocabulary by driving out the more reputable words. It leads one to look for expressions that are in themselves striking or "different," rather than those which convey the exact shade of meaning. The slangy person whose adjectives are limited to "rotten," "bully," "swell," and "stunning" finds himself at a loss when he attempts to describe a thing accurately.

The Spice of the Language

At its best, slang lends spice to language. It is often forcible, vigorous, and picturesque. Slang expressions are sometimes homely but effective figures of speech (*see* Figures of Speech). Most slang expressions are short-lived; but in every age there are some of these vagabond words which are, as it were, admitted into respectable society and become part of the standard language. Had our forefathers never used slang, our language would be much poorer. "Blizzard," "skyscraper," "mob," "humbug," and "banter," were originally slang expressions. "Squelch" was found to be so convenient and expressive a word that it has recently been admitted into good usage, and perhaps in the same way our word "swat," which the anti-fly campaign has made so popular, will some day appear in our dictionaries without the notation "slang." So "bluff" (to deceive by a confident manner), "graft," and "knock-out" are well on the road to respectability.

Originally regarded as the language of the criminal and vagrant classes and often springing from their jargon or *argot* as the French call it, slang has invaded almost every walk of life and almost every class or profession has its own expressions. The college student speaks of "boning" or "bucking" or "cramming" for an "exam." The actor waits to "see the ghost walk" (get his salary). The theatrical manager hopes the play will "register" or "get across" to the public. The artist complains that his picture has been "skied" (hung too high in an exhibition). The business man looks for a "slump in the market" if the "bears" triumph over the "bulls." The politician calls those who belong to no party "mugwumps."

New Words out of War Times

The World War brought into use a large number of new words, among which were not only many technical terms, but a great many vigorous slang expressions. "Doughboy," "Tommy," "poilu," and "boche" or "Heinies" and "Fritzes" were the terms adopted for the American, British, French, and German soldiers, respectively. "Gob" was the most popular name in the American navy for a "jackie" or enlisted man. The title "ace" was given to an aviator who had brought down five or more enemy planes. "Blighty" was the British soldier's term for home; to "go west" his figurative expression for death.

SLATE. School "slates" and the queer slate tombstones of colonial New England belong to a past day. But the dark gray (sometimes blue, greenish, purplish, or even red) stone from which they were made is still widely used for roofing, sinks, washtubs, flooring, blackboards, mantels, etc. For all these uses slate is especially suitable because of its smooth easily cleaned surface, and its property of splitting into thin slabs or leaves.

Slate is, in scientific terms, a metamorphic aqueous rock. It was first deposited by water as a bed of clay. If such clay becomes structureless stone by the mere removal of uncombined water, it is mudstone; if, having been deposited in layers, it has a tendency to split along the bedding planes, it is shale; but if—perhaps having first been tilted up at a new angle—it has then been compressed by tremendous force, so as to spread it out and produce cleavage planes at right angles to the direction of pressure, it becomes slate. This tendency to split into thin slabs is so characteristic of slate that the name is sometimes applied to shale and almost any rock which splits in this manner—as anthracite slates, whet slates, and talc slates.

Slate has not a wide geographic distribution. Most of the slate used in the United States is quarried in Pennsylvania, Vermont, Maine, Virginia, Maryland, New York, and Georgia. Most European slate comes from Wales and France.

SLAVERY AND SERFDOM. Go back as far as we may to the beginnings of history, we find the slave in all countries. We see him in Egypt toiling to build the pyramids; we meet him in Babylon; we find on the clay tablets in Assyria that a man and a camel alike sold for half a shekel of silver; and early in Jewish history we see Joseph being taken from the pit and sold by his brothers. For more than a thousand years slavery held sway in Greece and Rome. Athens was founded upon it, although she gloried in the principle of freedom; and even Aristotle, her greatest philosopher, accepted slavery as a necessity. In Rome the victorious conquerors brought home thousands of captives to serve in the houses and on the estates of the wealthy, one man sometimes owning hundreds or even thousands of slaves.

Slavery began even before man gave up his wandering pastoral life and settled down to till the soil. As an act of mercy the vanquished of the battlefield, with their wives and children, were made slaves rather than put to death. Sometimes men became slaves through inability to pay their debts; others were reduced to slavery by judicial sentence; among the ancient Germans men at times gambled away their freedom at games of chance. In times of peace, when captives were few, a slave trade was set up which dealt in slaves of many nationalities and all ranks; often a slave might be of higher birth and education than his master. Greeks enslaved Greeks, and were in turn made to serve the Romans, who often used such slaves to tutor their children. Countless captives were brought to Rome from Carthage, Spain, Gaul, and Asia Minor. In Athens slaves were usually treated kindly; but under Roman rule brutal treatment was sanctioned by both law and custom, especially on the great estates, so that the slaves at times revolted against their masters.

After the barbarian invasions of the 5th and 6th centuries A.D., chattel slavery (as it was called) gradually died out. In its place arose a new institution—the serfdom of the Middle Ages. The serf was not the chattel or "thing" of his master; he was a person, although of inferior rank. Like the free peasant (villein), the serf held and tilled a few scattered acres of land from the lord of the manor, for which he paid various dues and rendered two or three days' work a week on the land which the lord kept in his own hand. But unlike the free peasant, the person of the serf was unfree: He was "bound to the soil" and could not leave his master's estate; if he fled, he could be brought back, unless he found refuge "for a year and a day" in some chartered town. In the payment of dues, in regulations concerning marriage, and in rights of inheritance, there were distinctions which marked the serf as an "unfree" person. In England serfdom died out soon after the great Peasant Revolt of 1381, but in certain parts of France it lasted to the French Revolution. In Prussian Germany serfs were not freed until the beginning of the 19th century; and in Russia the great step which emancipated 23,000,000 serfs by imperial edict was not taken until 1861.

The Revival of Slavery

Slavery revived somewhat in Europe, especially in the 15th century, when the Portuguese began to introduce African slaves taken by the expeditions which they were slowly pushing down the west African coast. In the New World, the institution was revived with all its ancient horrors, to work the mines and till some tropical lands. At first the Spaniards tried to enslave the Indians; but they were not suited to such labor, and gradually dwindled in numbers under the unwholesome conditions until whole tribes disappeared. Negro slaves were then imported from Africa in increasing numbers to take the place of the Indians. The blacks proved equal to the tasks. They were accustomed to the hot sun, and became docile under cruel treatment. From the West Indies slavery passed to the mainland, the first shipload of slaves being landed in Virginia in 1619; and in course of time slave labor was considered indispensable on the great tobacco, sugar-cane, and cotton plantations throughout the South.

Guilty of nothing but "a skin not colored like our own," millions of Africans were torn from their homes, and European ship-owners vied with one another for the privilege of trading in these "cargoes of despair." But the sufferings caused by the loathsome traffic finally aroused the indignation of all thinking people. In the famous case of the negro Somerset, the courts of England decided that as soon as a slave set foot on the soil of the British Isles he thereby became free. The Quakers had long "borne witness" against slavery; English philanthropists such as Clarkson and others had written, spoken, and agitated against the slave trade; and the authors of the French Revolution had taken a firm stand in favor of the freedom of all men. Denmark took the lead in abolishing the slave trade in 1792; England followed in 1807; and in the same year the United States prohibited the importation of slaves into its dominions—that being the earliest date under the compromises of the Constitution at which such action could be taken. In 1815 the traffic received its final blow in the Council of Vienna, when, through England's efforts, all the powers represented agreed to abolish it.

Europe Leads the Way

The evils of slavery, however, could be ended only with abolition. Agitation toward this end was carried on in England by William Wilberforce, who devoted 50 years of his life to the cause, taking every opportunity in the House of Commons and elsewhere to expose the evils of the system. In 1833, a month after his death, a bill was passed providing for the emancipation of all slaves in the British colonies, and appropriating a sum of about $100,000,000 compensation to the owners. Great Britain thus won the distinction of being the first great modern nation to take such a step. Its example was gradually followed by the other European states. The United States remained for some years the only important nation which still clung to slavery.

In the United States the struggle between the slave and free states was long and bitter. Stirred by 'Uncle Tom's Cabin' and other anti-slavery literature, people of the Northern states did all they could to aid negro slaves to escape. In defiance of the stringent fugitive slave laws, which required that all escaped slaves should be returned to their owners, groups of prominent men organized the "underground railroad." Slaves who crossed the Mason and Dixon line were directed to trusted families who gave them food and shelter, and at night directed them to the next station on the line. This practice, which aided about 25,000 slaves to escape to Canada, was one of the grievances of the South against the North. When the Civil War finally came, President Lincoln in 1863 issued his famous Emancipation Proclamation; and in 1865 the 13th constitutional amendment prohibited slavery in the United States forever. (*See* Civil War and Reconstruction.)

The Evils of Peonage

In Spanish America, particularly in Mexico, where slavery was early forbidden by the Spanish government, a form of agricultural servitude of the Indians was established known as "peonage." Though now prohibited by law, the poorer people are still sometimes lured into debt by their employers and then kept as "peons," the law permitting this forced labor until their debts have been paid. At times since the

Civil War it has been charged that conditions similar to peonage have existed among the negro agricultural population of certain parts of the South.

Although prohibited, the slave trade is said to exist still to some extent in the Congo and Portuguese West Africa, as it does among savage tribes in other parts of the world. Mohammedan household slavery is also said to continue in spite of official prohibition.

SLAVS (*slävz*). The Slavic peoples bear a numerical relation to the Teutonic, Latin, and Celtic peoples somewhat like that which the huge solid bulk of Eastern Europe bears to the fringed and attenuated lands of the West. Estimates of the total number of the Slavs vary from 140,000,000 to 172,000,000, and the recent inroads of war, famine, and disease make all reckoning uncertain. Yet the Slavs far outnumber any other European racial division, as judged by the language test, without counting their emigrated members in Asia and America.

The Slavs are a generally broad-headed (brachycephalic) race, sometimes fair, though never so fair as the typical blond Teuton, and sometimes dark. The type, however, has been blurred by many racial crossings. Their name has been derived by an oft-disputed etymology, from a root meaning "glory," which appears in many Slavic names (for instance, Ekaterinoslav, "glory of Catherine"); and it is said—and likewise disputed—that our word "slave" comes from the many Slavic captives once sold in the slave-markets of Europe by their conquerors.

When the Slavs first emerged from obscurity, in the early centuries of the Christian era, their tribes were found northeast of the Carpathians, between the Oder and the Dnieper rivers. They were members of the great Aryan or Indo-European family of peoples and their nearest relatives are the Baltic Prussians, Lithuanians, and Letts. From this original center, they spread in all directions—pushed back on the north and west by Baltic and Teutonic tribes, overrun by successive invasions from Asia, and churned by migration and conflict into many separate nationalities. Some of these groups—as the Wends, Slovaks, Slovenians, Bohemians (Czechs), Moravians, Croatians, Bosniaks, and Dalmatians—while preserving a certain degree of individuality as peoples, became all but effaced politically through conquest, dynastic marriages, or voluntary acceptance of foreign rulers. The Poles, the most individualist and masterful of all the Slavic nations, declined in power through their turbulent and undisciplined aristocracy, and were dismembered in three great partitions at the close of the 18th century (*see* Poland). The vast empire of Russia, formed about the grand duchy of Muscovy, became one of the "six great powers" of the times just past. It included the Great Russians, Little Russians (Ukrainians or Ruthenians), White Russians, and the chief block of the submerged Poles. The Ukrainians probably diverge least from the primitive Slav type. Serbia, Bulgaria, and Montenegro had to battle for existence against the Turks since the 14th century; while Montenegro successfully resisted Ottoman conquest, the two former obtained their independence of the Turks only in the 19th century.

The eastern Slavs of Russia and, in the main, the southern Slavs of the Balkan peninsula, adhere to the Greek Catholic (Orthodox) church, and use the Cyrillic alphabet, a modified form of the Greek alphabet. The western Slavs—the Croats, Poles, and Bohemians, especially—were christianized from Rome and still adhere to the Roman Catholic church and use the Latin alphabet.

The Slavic peoples have never played a part in European history in keeping with their numbers and possibilities. In a sense they are the backward nations of Europe, politically and industrially retarded, partly by their own characteristics and partly by unfavorable circumstances. Brave and brilliant, the military Slavic nations were too jealously individualistic to submit to discipline and learn the value of union. The eastern and western Slavs, divided by religion, exhausted much of their energy in fighting against each other. The geographic position of the Slavic nations was also unfavorable, for it made them the great breakwater of Europe against Asiatic conquest. Successive waves of Avars, Huns, Magyars, Mongols, Tatars, and Turks again and again submerged the beginnings of Slavic culture, and receding left pools of alien population to muddy the Slavic streams into which they were absorbed.

But the Slavs have special gifts in literature and art—witness the great names of Turgenief and Tolstoy in literature; of Chopin, Dvořák, and Tschaikovsky in music; of Makovsky, Vereshtchagin, and Mucha in painting. Their character is widely different from that of other European peoples; the novelist Dostoyefsky complains that Russians are misconstrued at every turn.

The future condition of Russia, the fate of the resurrected commonwealth of Poland, and of the new states of Jugo-Slavia, Czecho-Slovakia, and Ukrainia, time alone can reveal. Their peoples clearly have not as yet been permitted to develop their own special contribution to the progress of civilization. Can it be that today we are at the Slavic dawn, as the break-up of the ancient Roman empire was the Teutonic dawn?

SLEEP. "Where was I when I was asleep, Mother?" This is the question little Robert asked his mother. "Why, right here in bed," she replied, "I watched you all the time."

This answer was true enough; but it did not entirely satisfy Robert, for he wanted to know what happened to him when he was asleep, and why he knew nothing and remembered nothing, and why the time seemed so short during the long hours of the night.

During the day of play and work Robert got tired. He used up the substances of his body faster than they could be repaired. This was true not only for his muscles by which all his movements were carried on, but also for his brain which directed his motions and received all the time the impressions which came from his eyes, ears, and other sense organs. The brain especially needed to be repaired, for without it all the rest of the body would be of little account. So the thinking machine stopped work. That is sleep.

The brain is a great switchboard by which nerve impulses are shunted in proper relation and the results of many of them stored up to form the basis of memory (*see* Brain). In sleep many of these connections are less close. Impulses cannot pass so readily. Thus the whole structure gets a chance to rest.

What Dreams are Made Of

A strong sensory impulse may still be able to break in and set the machine going. For example, a loud noise or a strong shake may wake one up. If a person eats too much of the wrong food, especially for supper, he has indigestion; and the nerves from the stomach may be stimulated and send strong impulses to the brain. Under such circumstances Robert's sleep is likely to be poor, and he may have bad dreams.

Dreams are due to the fact that certain regions of the brain are not resting. Impulses are passing in partial areas, just as one might imagine part of the central telephone exchange of a great city to be active, while most of it was shut down. Under such circumstances the intelligent distribution and understanding of news would be interfered with.

So it is in dreams. There are no actual sensations for comparison. "Common sense" is off duty. The memory connections are made in an irregular manner. Usually there are no open pathways to the muscles for accomplishing motions. The result is that dreams are unreal and often deal with impossibilities. They are like our imaginings and ideas when awake, except that they are not kept in order.

Sometimes in some persons the nerve switches to the muscles are open in sleep. Such people (whom we call "somnambulists" or "sleep-walkers") may walk or do other things in their sleep and afterward know nothing about it, because the knowing part of their brain was disconnected.

Thus you see the brain may be more or less active. It may act in parts. So also sleep may be more or less sound. It is soundest for the first hour or two. After that the soundness rapidly decreases. This can be determined by finding out how loud a noise is necessary to wake a person at various periods of sleep.

The Machinery Keeps Working

While the big brain, the *cerebrum*, is largely out of commission in sleep, many of the automatic subordinate centers continue active. Respiration goes on, though more slowly. The heart beats more slowly. Many reflexes are active. A person who is asleep will pull away his foot when it is tickled. He knows nothing about it, for the knowing part is off duty.

You might say that this is like a city where the main telephone system is discontinued at night, but the wires for the police and fire houses are still open. The body attends to the absolutely necessary things in sleep; but most of its activities are suspended.

One might think that during sleep when the brain is being repaired it would need more blood. But that is not so. Every organ needs most blood when it is in action; that is, when processes of combustion are going on and a large amount of oxygen must be supplied. The brain is no exception. During sleep it receives little blood. We say it is "anemic." One of the earliest signs of waking is the appearance of more blood in the brain. People in other conditions than sleep may become unconscious from too little blood in the brain, as in fainting.

As a result of these facts some scientists believe that the withdrawal of blood from the brain is the cause of sleep. Others think the anemia of the brain is a result, rather than the cause, of sleep. At present we have to say that the fundamental change that brings on sleep is not understood.

Most adults need about eight hours of sleep in twenty-four. Children need more. Coffee, tea, and some other drinks contain the drug caffein, which in many people produces sleeplessness. These drinks, therefore, should be used sparingly before bedtime.

We spend about one-third of life asleep. This shows its importance. Do everything you can to make your sleep healthful. Have a regular time for sleep. Have plenty of fresh air and not too many bedclothes. Then you will love your sleep and say with old Sancho Panza, "Blessings on the man who first invented sleep!"

SLIME MOLDS. Sometimes you will find a slimy yellow or orange mass, from the size of a pinhead to that of a man's hand, in forests upon black soil, fallen leaves, or decaying logs. These perplexing forms, called "slime molds," do not seem to be related to any group of plants and have raised the question as to whether they are to be regarded as plants or animals. The ordinary body is a mass of naked protoplasm, called the *plasmodium*, suggesting the term "slime." This body slips along like a gigantic amoeba. In certain conditions these slimy bodies come to rest and organize elaborate and often very beautiful spore-cases. Scientific name of slime molds, *Myxomycetes*.

SLOE. Dark purple branches ending in sharp points or spines, and studded with pure white blossoms or small round blue-black fruit mark the sloe, or blackthorn, a shrub closely related to the plum. It grows from four to ten feet high and is found in southern Europe and central Asia. The fruit is bitter and is used only in making gin and wine and occasionally in preserves. Walking sticks, policemen's sticks, clubs and tool handles are made from the wood, which is hard and tough and capable of taking a high polish. The wild yellow plum and the black aloe, a medium sized tree, found on the eastern mountains, are American species of the sloe.

The scientific name of the European sloe is *Prunus spinosa*. Its leaves are small, resembling tea leaves, and grow on short petioles; flowers small, single, appearing in early spring usually before the leaves; fruit the size of a pea. The sloes are shrubs of the *Rosaceae* family.

SLOTH. These curious animals derived their name from the fact that they usually appear lazy and sluggish in movement, though at times they show considerable agility. Sloths live in trees in the forests of Central and South America; they are indeed the most strictly tree-inhabiting of all quadrupeds. By means of their hooklike claws they cling to the branches with their backs downward, and so appear upside down. They rarely descend to the ground, and crawl on it with difficulty. Their food consists of leaves, young shoots, and fruit. They are silent inoffensive animals and move about mostly at night.

There are two sub-families of sloths—the *ai*, or the three-toed sloth; and the *unau*, or two-toed sloth. Both are covered with long coarse hair, the shafts of which are roughened or fluted. This hair is naturally grayish, but in the damp forest it is covered with a growth of algae, imparting a peculiar greenish color which makes the animal difficult to distinguish among the foliage. In dry climates the algae disappear and the hair resumes its natural color.

HE WALKS UPSIDE DOWN

The Sloth never, if he can avoid it, walks upright upon the ground. Even in his sleep he hangs upside down.

Scientific name of three-toed sloth, *Bradypus tridactylus;* of two-toed sloth, *Choloepus hoffmanni.*

SMELL. The most remarkable fact about our sense of smell is the excessively small amount of substance needed to stimulate the nerve endings in the nasal passages. Some substances can be detected if as little as one thirty-billionth part by weight is present in a given weight of air. Many animals have a far keener sense of smell than man. Just imagine how infinitesimal must be the traces left which enable a bloodhound to follow a criminal many hours after he has escaped! Every dog can recognize his master by the odor, which shows that every human being must have a different odor, though it is ordinarily so faint as to be imperceptible to our own sense of smell.

In primitive men, just as in animals, smell was probably of importance in locating food and avoiding enemies. If you wish to know how different people would be if their sense of smell were as acute as that of the dog, read the story by Mark Twain entitled "A Double Barreled Detective Story."

Smell is closely related to taste, each sense being aroused by chemical substances coming in contact with the nerve endings. In the case of smell the substance must be in the form of a gas. Gases diffuse through the air, consequently we can recognize things at a distance by their odor. The endings or receptors for smell cover a very limited area in the upper part of the nasal cavities. They are so arranged that the air is drawn over them when we breathe.

Many foods have a distinct odor, and the gaseous particles reach the smell receptors when we eat. Hence we confuse taste and smell. The so-called taste of fruits, wine, etc., is really an aroma or smell. Test this by holding your nose and chewing some dry coffee. You will not "taste" anything, but the instant you take a breath the so-called "taste" of coffee will become apparent. This explains why food does not "taste" right when you have a cold. Your sense of smell is lost by the partial stoppage of the nasal passages.

The many kinds of smells have been divided into nine classes. But the actual number of fundamental odors or kinds of olfactory endings is not definitely known.

Smells are intimately related to the emotions. Hence the division of odors into agreeable and disagreeable is probably fundamental and forms the basis on which many animals take their food and know their enemies, mates, etc. Among civilized men likes and dislikes may be cultivated, hence people do not agree as to which odors are pleasant.

SMITH, CAPTAIN JOHN (1580–1631). The story of the life of Captain John Smith, as told by himself, reads more like a tale from the 'Arabian Nights' than like a true autobiography. According to his own account he ran away from his home in England at an early age, to seek adventure. While traveling through France he was robbed and left helpless in a forest, but was saved from death by a kindly peasant. Sailing from France with some pilgrims bound for the Holy Land, he was thrown overboard by his companions because they regarded him—a Protestant heretic and unbeliever—as responsible for the storm by which their lives were threatened. He saved himself from the sea, however, and later fought in a war against the Turks, three of whom he killed in a single combat. He was afterward captured and sold into slavery by the Turks, but made his escape by killing the guard placed over him. After wandering through Europe, he returned to England in 1605, and joined an expedition which was preparing to go to America to found the colony of Virginia.

During this voyage Smith's life was again in danger. He was accused of conspiracy, and at one time members of the party prepared to hang him. His life finally was spared, but he was kept under restraint until after the expedition reached the James River. Then it was found that Smith was one of the councilors who had been appointed by the Virginia Company in England to govern the colony. Soon he was forced by the incompetence of others to take the lead in the Jamestown settlement. He compelled all to work by his famous order, "He who will not work shall not eat." He forced the Indians to supply the starving colonists with corn, and at the same time kept the savages in order.

CAPTAIN JOHN SMITH BATTLES THE TURK

Captain Smith, as the champion of the Christians, killed three Turkish champions in turn. At this period (about 1600) the full suit of war harness had already gone out of use for common soldiers, but was still worn on special occasions by great nobles, and as you see here, by chosen champions.

Soon after the settlers landed, Captain Smith had a very exciting adventure. It was generally believed that the "South Sea" (Pacific Ocean) lay just beyond the mountains, so with a few companions Smith sailed up the Chickahominy River in search of it. When the stream became too shallow to go farther by boat, he landed and with one Indian pushed forward through the forest. Soon he was set upon by a band of hostile Indians and made captive. They were about to shoot him with their arrows when he aroused their curiosity by showing them his pocket compass, and they spared his life. After taking him to many of their villages, they finally brought him before their chief, Powhatan, a tall stalwart man dressed in a coonskin robe. Presently the Indians seized Smith, bound him, and laid his head upon a stone, while a warrior stood ready to slay him with a club. At this moment, according to Smith's account, Powhatan's little daughter Pocahontas sprang forward, clasped her arms about the captive's neck, and prevailed upon her father to spare his life and send him back to Jamestown. The truth of this romantic story is doubted by many, but the value of Captain Smith's services to the colony is acknowledged by all.

While out on one of his many exploring expeditions Captain Smith was wounded by an explosion of gunpowder, and in 1609 he returned disabled to England, and never again set foot on Virginian soil. After recovering from his wound, however, he explored and charted the coast of southern Canada and northern United States, to which at his request Prince Charles gave the name of "New England." He also spent much time in writing, and although his works are not fully reliable, his 'True Relation of Virginia', his 'Travels', and his 'General History of Virginia' still furnish us much valuable information concerning the Jamestown settlement.

Doubtless Captain Smith was something of a kindly braggart and had an over-vivid imagination. But most certainly he was also a very active, courageous, resourceful gentleman—"ever hating baseness, sloth, pride, and indignity more than any dangers"—and to him more than to any other one man was due the success of the first colony in Virginia.

SMOKE. The vapor produced by burning any substance, usually wood or coal, is called smoke. The smoke from burning wood is almost colorless, and consists mainly of carbon dioxide and water, while that from burning bituminous coal is darker, being mixed with an oily vapor and soot, which is finely divided carbon. Acetylene gas, unless used in a special burner, gives a very smoky flame, caused by the great excess of uncombined carbon.

The more perfect the combustion, the less is the smoke. The remedy for the clouds of smoke which come from factories, foundries, and innumerable fires in many of our cities is more perfect combustion of the coal used, which also means economy of fuel. A smoke investigation in Chicago showed that the chimneys of that city were pouring out every year nearly 200,000 tons of solid matter.

Smoke in the air is one of the causes of fogs. When the temperature falls at night, moisture condenses on the small particles and they remain suspended in the air with their burden of water. The fogs of large cities, like the famed fogs of London, are largely due to incomplete combustion of fuel in the multitudes of furnaces and stoves, and the consequent production of smoke.

SMUTS, JAN CHRISTIAN (born 1870). In the final struggle of the Transvaal Boers against the British which culminated in the Boer War of 1899–1902, there were few leaders who were abler or more devoted to the Boer cause than Gen. Jan Smuts. He was the descendant of a long line of Dutch farmers, but after graduating from a Cape Colony college, he had a brilliant career at Cambridge University, England, where he had studied English constitutional history and law with Frederick William Maitland, the greatest living master of these subjects. On returning to South Africa he had soon attracted the attention of President "Oom Paul" Kruger, who appointed him state-attorney of the Transvaal when he was but 28 years old. Then when the Boer War came he won great praise as a general for his skill in carrying out rapid movements; no leader more skilfully evaded the traps set by the British, and none did more to delay the final crushing of Boer resistance.

JAN SMUTS
Boer Soldier and British Statesman

Yet less than a score of years later this brilliant enemy of British rule had become the prime minister of the whole British Union of South Africa, and was recognized as one of the greatest living statesmen of the British Empire.

In the reorganized Transvaal he had become the right-hand man of Gen. Louis Botha, the leader of the People's Party, and in 1906 had journeyed to England with him and received from the Liberal leaders of the British government the promise that the Transvaal should receive self-government. In return Smuts and Botha promised loyalty on the part of the Boers to Great Britain, a promise which they kept.

Smuts played a considerable part in bringing about the Union of South Africa (1909), and when Botha became prime minister of the Union, Smuts was made minister of defense of the interior, and of mines. He was one of the few British colonials who realized that Germany was preparing for a great war, and he feared that the Germans would use native troops—as they did—in the attempt to sweep the British from South Africa.

When the World War broke out in 1914 many of the Boers, stirred up by Germany, sought to free themselves from British control by rebellion. But Smuts and Botha had promised loyalty to the British Empire and they kept faith; they put down quickly and harshly the Boer rebellion. Then Smuts led a military expedition across the desert of German Southwest Africa, and won that territory for British rule. He headed the expedition to German East Africa, where his military strategy won reluctant praise even from German army critics.

By this time Smuts had been marked out in Britain as an important military and political figure, so he was summoned from South Africa to represent that country in the Imperial War Conference. Then he was invited to attend the meetings of the British War Cabinet, and at the close of 1918 was employed in secret negotiations with Austria for peace. During the last year of the war, he made many speeches in Britain, speeches that won world attention and marked him off as the great spokesman for British Liberal opinion. He never doubted the outcome of the war, such was his faith in the final victory of moral issues; they were stronger than armies and would prevail. He did a great deal to keep up the spirits of wearied Britain. Like President Wilson he hoped for a new world after the war; like Wilson he wished for just boundaries based upon nationality, dreamed of a peace treaty that would bring about the reconciliation of nations and make for the ending of wars, and favored a League of Nations. But he was never so optimistic as Wilson; he never was so sure that the League of Nations could be established fullgrown.

General Smuts went to the Peace Conference as the representative of South Africa. He was called upon to help frame the covenant of the League of Nations, and some parts of that document show his handiwork. But early in the making of the treaty he saw that it would fall short of his wishes; pacing the lobby of his hotel, he once said to his friends, "God is not writing this peace." At the end he signed the treaty, but issued a statement criticizing it.

Soon after his return to South Africa Botha's death made him prime minister of the Union. In July 1921, he was entrusted with the preliminary negotiations between Lloyd George and the Irish Republican leaders, a task which he performed with rare tact. Some men have dared to call him "the wisest man in the British Empire."

SMYRNA. For more than 25 centuries Smyrna, the most important seaport of Asia Minor, has been one of the chief centers of trade between East and West. There are, however, few remains of Smyrna's early greatness, for it suffered too severely at the hands of the numerous conquerors of Asia Minor, including Tamerlane, who nearly wiped it out at the beginning of the 15th century.

Today Smyrna presents a fascinating mixture of Oriental and European life. The flags of half the nations of Europe fly over the ships in its busy harbor, and in the foreign quarter are fine hotels, theaters, and moving picture houses. Yet a walk through the Greek, Armenian, and Jewish quarters leads to the heart of a district heavy with age and the odors of the Mohammedan East. Men in baggy trousers loiter before strange shops and coffee houses; and you can watch the slow-moving throng, made up of dervishes with cone-shaped hats, wild herdsmen from beyond the mountains, veiled Turkish women who glide by like shadows, shouting peddlers, crying children, muzzled camels swaying under their heavy pack—an endless brilliant procession.

Here, where one of the earliest Christian churches was founded and where its bishop, Polycarp, was martyred by the Romans in 155 A.D., are daily heard the calls to prayer from 50 mosques: "Allah is great! There is no God but Allah!" But today the rule of the Turk has disappeared, and under the peace treaties which ended the World War, Smyrna was given to the kingdom of Greece.

Formerly Smyrna was noted for its beautiful rugs, but the use of machine-spun yarn and coal-tar dyes has sadly degraded the ancient art. The chief exports are figs, tobacco, raisins, hides, sponges, rugs, silk, and cereals. Population, about 350,000.

The SAGE *and* SLOW-FOOTED SNAILS

Some of the Remarkable Habits of These Creeping Creatures — Those that Own Their Own Homes, and Those that Live in the Open Air—How They Scrape Up Their Food with Tiny Files

SNAILS AND SLUGS. Dull creatures, you find the snails at first, and dismiss them as not worth your interest. But wait! Did you know that snails have a highly developed "homing" instinct by which they find their way back to their hiding places in the most wonderful and mysterious way? Did you know that a snail weighing less than half an ounce has been known to drag more than a pound of weight over a smooth table? Did you know that if a snail loses one of its "eye-horns," it simply grows another? Did you know that a snail can crawl across the edge of the sharpest razor without cutting itself? These are just a few of the interesting things about these queer mollusks.

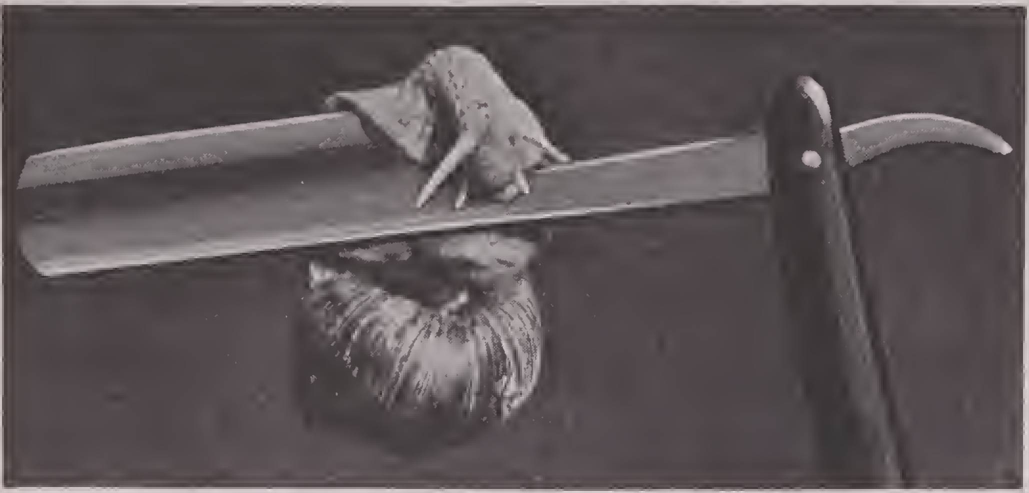
You are looking at this Snail through a pane of glass. With the aid of the "glue" it manufactures and the wave-like movement of its "foot," it can crawl safely and steadily over the smoothest, steepest surface.

There are two great classes of snails—those with shells, and those without. Those that live in shells have a coiled body which fits into the coil of their shell; this shell they carry about with them. Their bodies are provided with strong muscles by means of which the body can be withdrawn entirely within the shell when danger threatens. Some snails have a horny disk on the foot which is just the size of the opening of their shell. When the snail is fully withdrawn within the shell this horny disk just closes the opening, and thus the soft body is completely protected. Other snails seal up the doors of their houses with a slimy substance which hardens, and in this sealed-up condition they can live through a dry period which would otherwise kill them.

In its slow-going travels, the Snail drags its coiled shell along on its back, while its horn-like eyes are extended, turning inquiringly from side to side. If disturbed, however, horns and all are drawn back into the shell.

Some land snails, commonly called slugs, have no shells, or only very tiny scales, on the back. Their bodies are soft, yet muscular and tough, and are straight, not coiled. The common garden slugs are small, black, or dark brown, and less than an inch in length when fully extended. Another species which is becoming common is the "great gray slug." This is a handsome creature, being light gray marked with black, and often reaches a length of four inches. It was brought into the United States some time ago from Europe. The sense of smell is very delicate in slugs, and they are able to detect the presence of food at long distances. Some slugs are very destructive to lettuce and cabbage leaves, as well as to fallen fruit. In Europe they are serious pests.

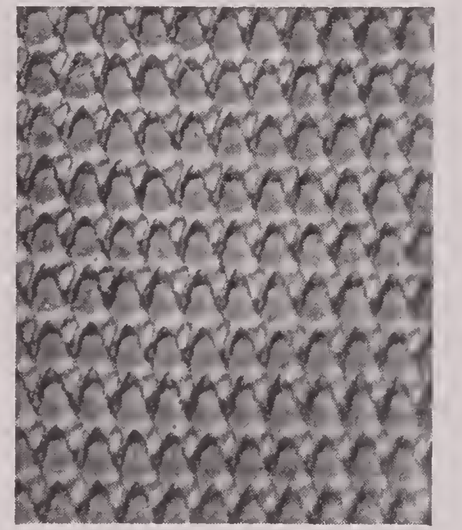
A CLOSE SHAVE WITHOUT A CUT



Perhaps you have thought that the Snail is very sensitive, and needs a shell to protect him. So he does, but the skin of his foot is very tough and so made that he can climb gracefully over the edge of the sharpest razor without injury.

Snails live in salt water, in fresh water, and on land. They feed mostly on plant material, though many are flesh eaters. They cut or shred their food to pieces by means of a peculiar ribbon-like apparatus in the mouth, which is called the *radula*, a word that means "little file." The eyes, which look like tiny black dots, are located at the tips of the long antennae, or tentacles, or at the bases of the smaller pair. (*See* Eyes.) A snail can be made to withdraw the tentacles which bear the eyes by flashing the sunlight on its head with a mirror. This shows that the eyes are sensitive to light, though they are not sufficiently developed to give images of objects.

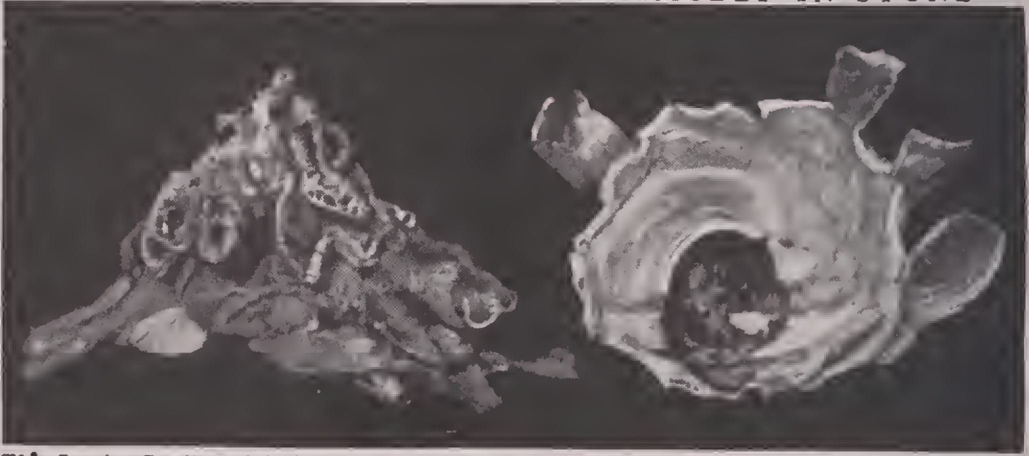
HIS TONGUE IS A FILE



The tongue of the Snail has hundreds of tiny "teeth," with which it files away bits of food. This photograph shows some of the teeth, magnified 40 times.

Many snails, both water and land forms, breathe air, as the mammals do. These are called the "pulmonate" snails. Their lungs are simple and saclike, and are located about the middle of the body, nearer to the head than to the tail. The breathing pore opens and closes from time to time, and can be easily seen on the back near the head, a little to one side. Snails which breathe in the water are provided with delicate fringes of leaflike gills, like those of the clam, the oyster, or the fish. Over these gills pure water is kept flowing, and from this the blood takes the oxygen. These snails, therefore, do not need to come to the surface to get air. The big marine or saltwater snails, like the whelks and winkles, which live on the bottom of the ocean, breathe in this way.

THE CARRIER SNAIL WRAPS HIMSELF IN STONE



The Carrier Snail, which lives in Borneo, is not satisfied with the protection he gets from his shell. He hides even the shell by covering it with small stones and bits of rock, which he fastens on with a cement he manufactures.

Snails multiply by laying eggs, often in wonderful capsules. Those that live on land hatch out directly as little snails; but those that live in the water come out of the egg as very minute creatures which go swimming freely through the water by means of numerous fine vibrating hairs ("cilia") located at various portions of the body. Soon the little ciliated young, or larvae, settle down, lose their cilia, and develop into snails.

Those that build shells add coil after coil to their houses as they grow, building it up from the "front door" as fast as they need more room. Some of the most beautiful of animal structures are the snail shells, especially those which come to us from tropical waters. (*See* Shells.)

Snails crawl upon the flattened under-portion of the body, which is called the "foot." This foot is very tough and muscular, though soft and smooth, and contains, in many kinds, little glands which pour out slimy fluid that makes it easy for the snail to glide.

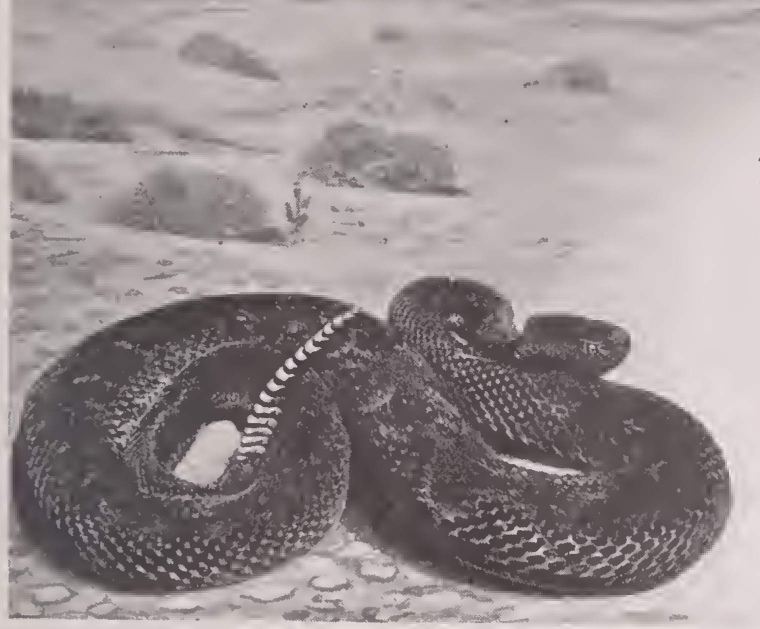
The rocks on sea-coasts are often almost covered with little marine snails of many different species. These small forms are known as periwinkles. The commonest one is nearly globular, or ball-shaped, and is a very dark gray. Another pointed yellowish shell is inhabited by a snail known as the oyster drill, because it makes round holes in the shells of the oyster, upon whose soft flesh it feeds.

Several species of the shelled snails can be found commonly in ponds and streams feeding on the leaves of the water plants.

A large European land snail is eaten in France and Italy and is considered a great delicacy. Periwinkles also are eaten in England.

Snails and slugs belong to the gastropods, the largest of the mollusk classes (*see* Mollusks).

CREATURES *that* WALK *on* THEIR RIBS



The Queer Habits of the Cold-Blooded Reptiles Who Have Lost their Legs and Who Can't Close Their Eyes

SNAKES. As far as we can go back in history, we find that snakes have exerted a strange fascination upon men. In olden times they were worshiped as gods or friends of the gods; they were symbols of wealth and knowledge, and the "wisdom of the serpent" was the subject of many a proverb. Among the Greeks they were dedicated particularly to Aesculapius, the god of medicine. The part which the serpent played in the Garden of Eden is well known. In the Middle Ages they became associated with black magic and evil spirits, and countless myths center about monstrous serpents guarding treasures in caves, or dwelling in the depths of the sea. The majority of people even in civilized lands continue to look upon snakes with unreasoning fear and dread. How often you hear the remark: "I can't tell you why, but snakes make me shudder!" It isn't the danger of being poisoned that causes this, for the feeling exists toward snakes that are known to be harmless and gentle.

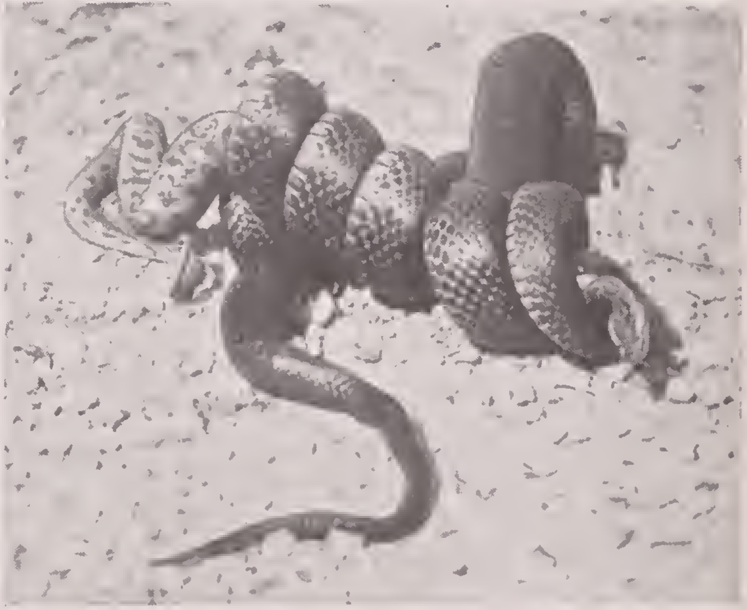
The fact is that snakes are indeed uncanny in appearance and habits. In the first place, they never close their eyes. They can't, for *they have no eyelids*, but only a tough transparent membrane to protect the eyeballs. This gives them that "cold and glassy stare" with which they are popularly supposed to hypnotize their prey. Another "creepy" spectacle is to see a snake crawl out of its old skin, appearing clean and glossy in its new dress. This habit formerly led people to believe that snakes were able to renew their life from time to time, and that they never died. Even when cut in two, the two parts were wrongly supposed to crawl together again and be mended.

How Do Snakes Get About?

But more impressive and mystifying than anything else is the motion of snakes. Their legless bodies seem to flow like living streams of water, with apparently nothing to push them or pull them. They crawl over stones, up the trunks of trees, wind themselves in the most intricate coils, then untangle again, rear their heads in the air, or glide through some narrow hole—all without seeming to exert a single muscle or move a single bone.

The secret of this is that a snake *walks with his ribs.* These are very many in number, each being fastened to a section of the backbone, and each section of the backbone being connected with its neighbors by ball-and-socket joints, which permit the greatest freedom of movement. The tips of each opposed pair of ribs are attached with muscles to one of the cross-wise scales of the abdomen. Thus the snake can move each of these scales independently, so that they act as feet, their sharp edges catching on any small roughness in the path of travel, and as they are drawn backward, pushing the snake's body ahead. When snakes are in no hurry, they usually move in a perfectly straight line, but for speed they throw their body into a series of *S*-shaped curves. In this manner many of them are able to get over the ground with amazing swiftness. No snake, however, is able to leap off the ground by the power of its coils, as might be imagined from the reports of certain travelers. Despite the lightning-like stroke of an angry snake, it never succeeds in propelling itself farther than its own length.

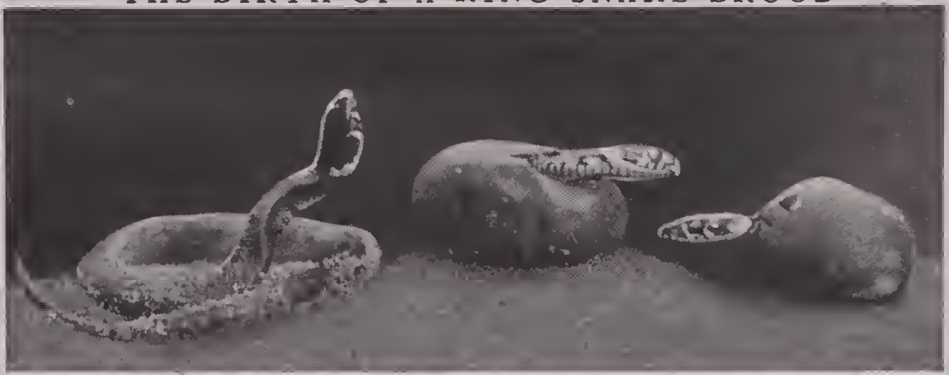
A KING SNAKE CONQUERS



This is a battle to the death between a King Snake and a Copperhead. You can see how the King Snake has coiled around his weaker foe, whose fanged head is already hanging powerless.

Snakes are silent secretive creatures. They appear and disappear with soundless mystery. When cornered and excited they have no voice, except a long sinister hiss. Wild animals in general appeal to us by their cries, like a half-understood language. We love the cheerful humming of the bee, the chirp of the cricket, the croaking of the frog; we can even find something remotely human in the bellow of the alligator or the howl of the wolf. But snakes can make no such appeal; even the noise of the "rattler" has a "dead inhuman sound."

THE BIRTH OF A RING SNAKE BROOD



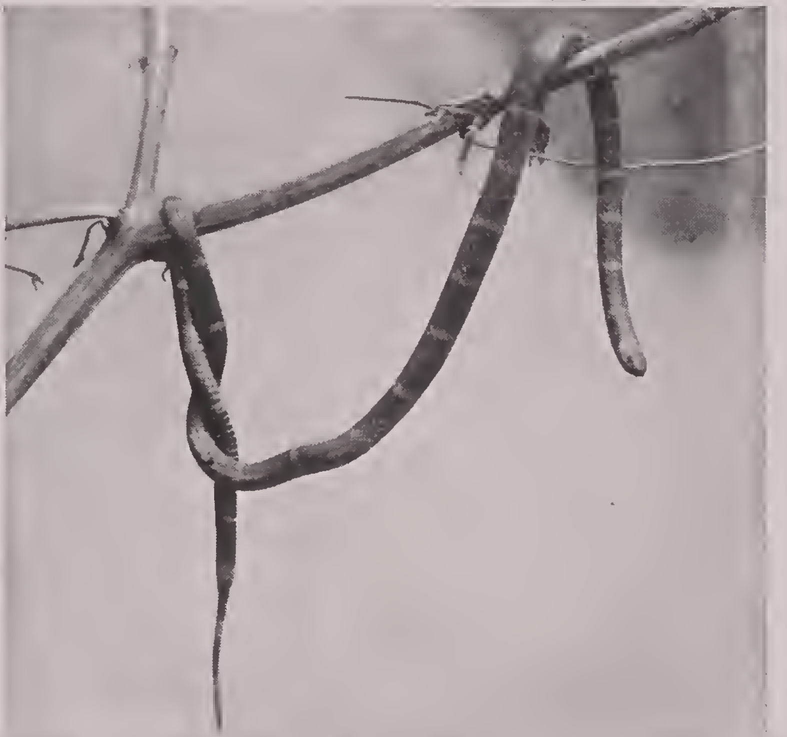
The Ring Snake is one of the species which lays eggs. Two of these young snakes are just breaking through their shells, while a third is stretching himself for the first time.

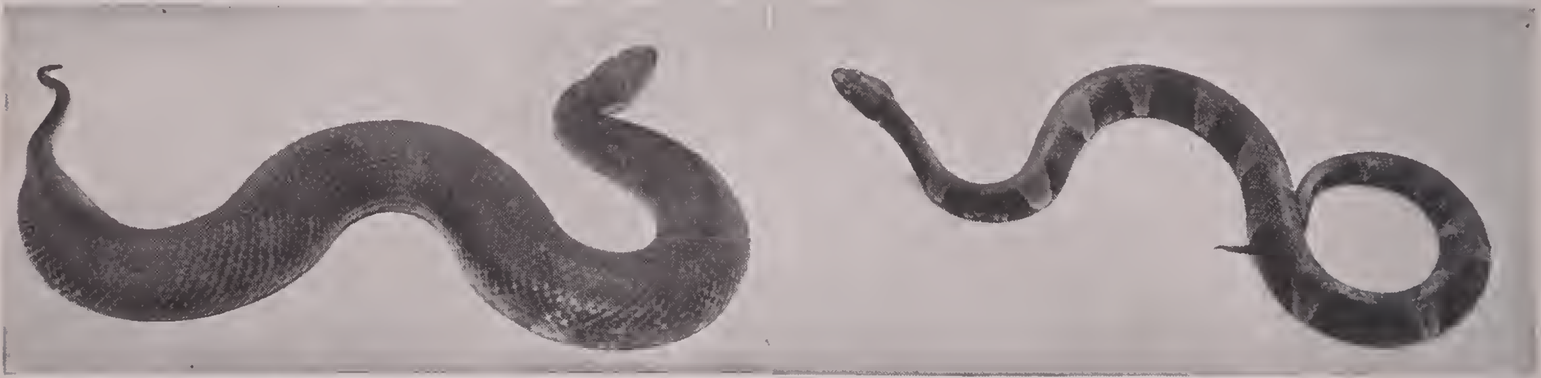
Yet when you see a snake's deep-cut mouth, curved back as in a cruel smile, and catch a glimpse of the forked tongue, darting in and out like an electric spark, it seems as if the creature could speak if it only would. In fact, however, this exhibition denotes chiefly fear and curiosity. The snake would gladly escape if it could, but instinct tells it that its long thin body is in great danger when stretched out flat on the ground; a slight blow will break its back. So it coils and hisses hoping to drive you away; and its forked tongue, which is believed to be a sense organ like the feelers of insects, is extended from its sheath on the lower jaw in the hope of finding out what sort of a being you are.

The prejudice against snakes has always blocked a better knowledge of them, yet they present an opportunity for a fascinating study. As we shall see later, there are only four kinds of poisonous snakes in North America outside of Mexico. Comparatively few people are killed by their bites, because the snakes usually do everything in their power to avoid contact with men. The victims of most of the fatal accidents are persons who become careless with captive snakes.

Nearly all snakes catch and kill their prey, which, according to the snake's size and habits, may consist of insects, fish, frogs, lizards, other snakes, birds and their eggs, rats, mice, rabbits, gophers, and other small mammals. Many snakes, like the boa constrictor and anaconda of South America, the common king snake of the United States, and others, wrap themselves around their victims and crush them by constricting or drawing together the folds of their bodies. The constricting power of a 20-foot anaconda is doubtless great enough to kill a cow, but stories of these snakes devouring cattle, horses, or men are untrue. (*See* Boa Constrictor.) The poisonous snakes usually rely on their venom to put an end to the struggles of their prey. The others simply swallow their catch without attempting to kill it first. This accounts for the fact that snakes which are disturbed immediately after a meal sometimes disgorge live frogs, lizards, etc.

THEIR POISON KILLS





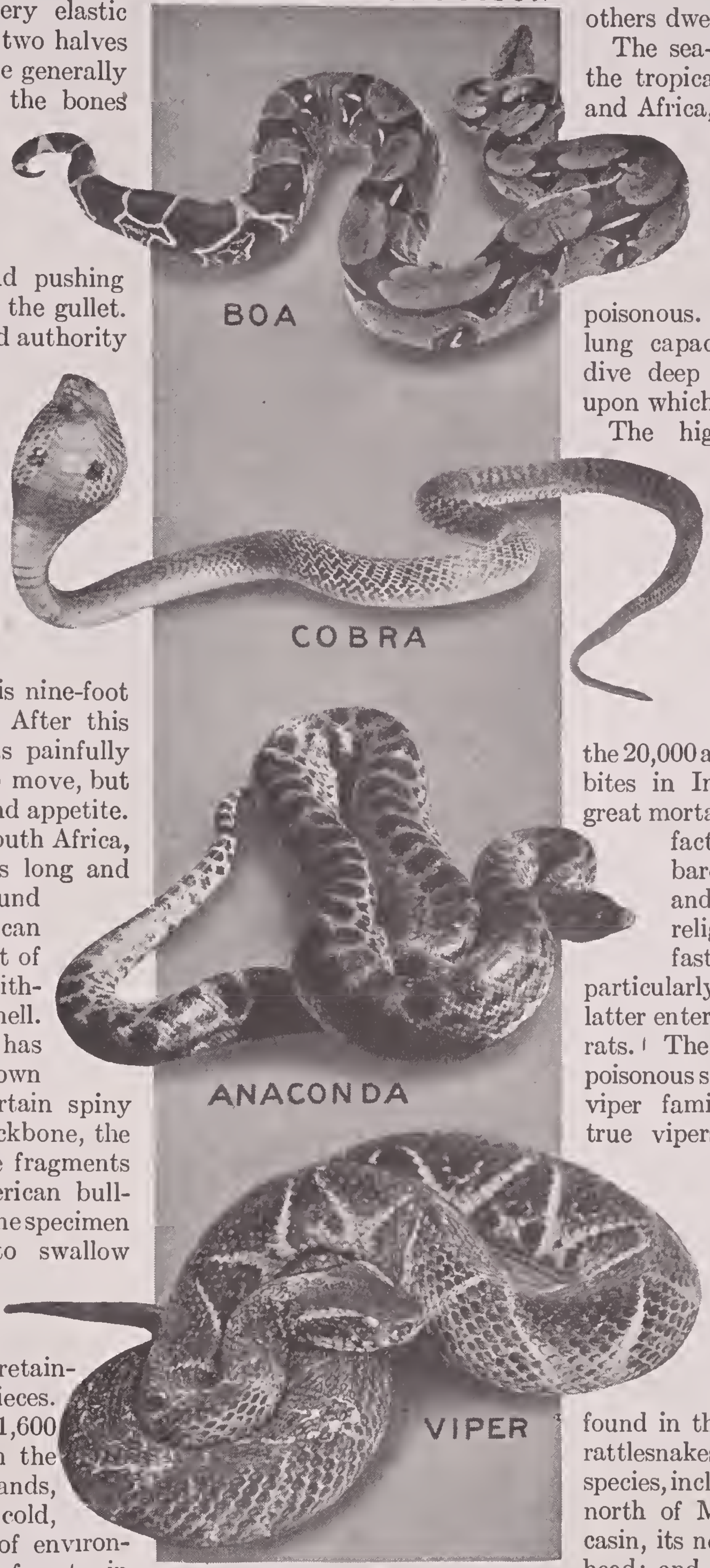
Here are the three snakes which, with the Rattler, are the only poisonous snakes in the United States and Canada. At the top is the Coral Snake, a small creature with red, yellow, and black rings around its body. The heavy-bodied snake below is the Water Moccasin, while the one with the light and dark patches is its near relative, the Copperhead.

The size of the morsels which snakes can swallow is astounding and indicates one of the important peculiarities of a snake's structure. This consists in the very elastic connection between the two halves of the lower jaw, and the generally loose attachment of all the bones around the mouth and throat which permits wide stretching. The teeth are sharp and curved backward, well suited for gripping and pushing the prey far down into the gullet.

A story is told on good authority of two captive boa constrictors which started to swallow the same pigeon from opposite ends. When their noses met in the middle, both were either unable or unwilling to stop their meal. The result was that one which was slightly larger swallowed the pigeon and his nine-foot brother snake as well. After this dinner, the survivor was painfully distended and unable to move, but soon recovered health and appetite.

The "egg-eater" of South Africa, which is rarely 20 inches long and not much bigger around than a man's finger, can perform the amazing feat of swallowing a hen's egg without breaking the shell. When the egg, however, has passed a few inches down the neck it strikes certain spiny projections from the backbone, the shell is broken, and the fragments vomited out. The American bull-snake is less particular, one specimen having been known to swallow 14 eggs in succession, crushing the shells by pressing its stomach against the ground, but retaining and digesting the pieces.

MUSCLE VERSUS POISON



The Boa and the Anaconda are the largest and most powerful of all snakes, catching and crushing their prey in their powerful coils. Yet the Cobra and the Viper, small as they are in comparison, can kill creatures the other two would not dare to attack, for they possess deadly poison fangs. These pictures, of course, do not show the relative sizes.

There are about 1,600 species of snakes. With the exception of a few islands, and regions of extreme cold, they exist in all sorts of environment—in dense tropical forests, in deserts, on high mountain tops. Some burrow in the ground, some live entirely on the surface, some spend most of their time in trees; others frequent swamps or fresh-water lakes and rivers; and still others dwell in the sea.

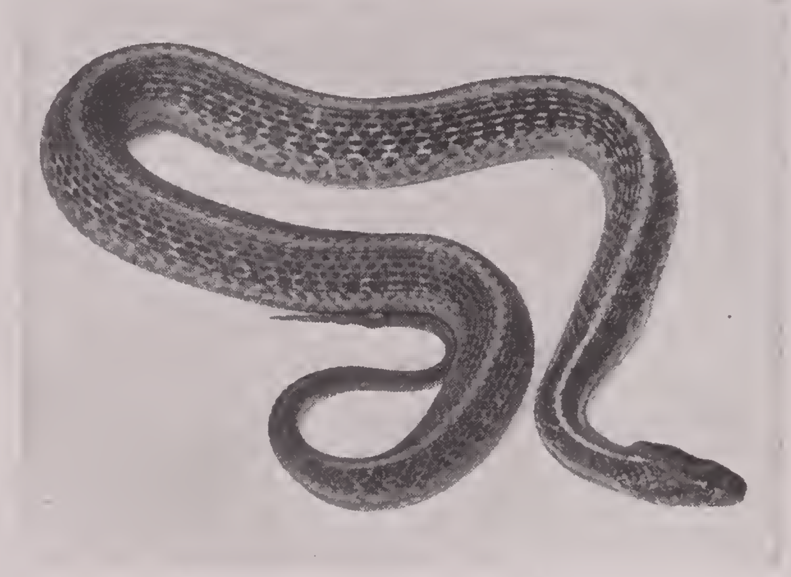
The sea-snakes, found mostly in the tropical waters bordering Asia and Africa, usually have the body flattened from the sides, which makes them powerful swimmers, but awkward on land. They number about 50 species—all exceedingly poisonous. They have tremendous lung capacity, so that they can dive deep in pursuit of the fish upon which they feed.

The highly poisonous snakes found on land number not more than 250 species, of which 150 belong to the sub-family called *Elapinae*, which includes the cobra and the "krait," the two most dangerous of all snakes, and which are chiefly responsible for the 20,000 annual deaths from snake bites in India (*see* Cobra). This great mortality is chiefly due to two facts; that the Hindus go barefooted through fields and jungles; and that, for religious reasons, they steadfastly refuse to kill snakes, particularly cobras, even when the latter enter their houses in search of rats. The remaining 100 highly poisonous snakes belong to the great viper family, which includes the true vipers (*Viperinae*) and the pit-vipers (*Crotalinae*). The latter family contains the rattlesnakes, the moccasins, the deadly "fer-de-lance," the bushmaster, etc. (*see* Vipers).

The four kinds of poisonous serpents found in the United States are the rattlesnakes, of which there are 14 species, including the pigmy rattlers, north of Mexico; the water moccasin, its near relative, the copperhead; and the coral snakes, with two species (*see* Copperhead; Moccasin; Rattlesnake). It is important to know them all, particularly the copperhead and moccasin, for they resemble many of the harmless snakes. Such knowledge not only protects human beings from harm, but tends to stop the wholesale destruction "on suspicion" of all snakes, many of which are of great value to the farmer, as they eat up quantities of insects, rats, mice, gophers, prairie dogs, and other pests.

The coral snakes are among the prettiest of all reptiles. They are ringed with brilliant colors, and appear harmless and gentle. Yet they are of the same family as the deadly cobra, and their tiny fangs, which they sometimes use with treacherous swiftness, inject a poison of fatal strength. The two species in the United States are the "harlequin" and the "Sonora" coral snake, the former found throughout the South, the latter confined to Colorado and Arizona. They may be distinguished from certain harmless snakes of similar patterns by the fact that the colored rings are arranged in the following order: red, yellow, black, yellow, red. Even so, it is best not to place trust in a hasty identification.

THE HARMLESS COLORFUL GARTER SNAKE



The Garter Snakes are the most numerous and most widely distributed of all American snakes, being common in all sections except the arid western regions. Their favorite haunts are grassy meadows and the borders of streams.

The venoms found in poisonous snakes are usually clear yellowish liquids, which get their deadly power from certain highly complex chemicals of the proteid class. When the snake strikes its victim this poison usually enters the tissue immediately beneath the skin and from there is absorbed into the blood and distributed through the system. All snake poisons act principally upon the nerves with a paralyzing effect, beginning with weakness in the legs and arms, which quickly spreads to the entire body, followed by spasms, labored breathing, coma, and death.

The Poison of the Deadly Cobra

Cobra poison, which is considered the most deadly of all, creates at first a burning pain in the wound. One of its characteristic effects is to make the victim speechless after a few minutes. Rattlesnake poison, while less deadly, is more violent in its action upon the system, causing staggering fits, vomiting, swelling of the limbs, and acute spasms. There is danger that the person who survives the first effects of a rattlesnake bite may die weeks afterward from gangrene, which often sets in at the place where the poison entered the body.

In treating any snake bite the first thing to do is to tie a string or rope above the wound and twist it tightly with a stick. Then gash the wound freely with a knife to make it bleed. Some authorities warn, however, against sucking out the poison with the lips. Cauterize the wound, if possible, with nitrate of silver, or apply permanganate of potash. Small doses of some active stimulant should be administered to keep up the heart action, but large quantities of alcoholic liquors are very harmful. The string or rope must not be left on for more than half an hour or gangrene will set in. Antitoxins or "antivenins," as they are called, have been produced which are useful to snake collectors and others who handle poisonous reptiles. They are injected into the blood like other serums (*see* Antitoxins).

In addition to the highly poisonous snakes mentioned, there are about 300 species of "semi-poisonous" snakes, which, either because of the imperfect arrangement of their fangs or because of the weakness of their venom, are unable to do much harm to large creatures. Only two unimportant members of this group occur in the United States.

This leaves 1,000 or more perfectly harmless species of snakes, which are made to suffer for the sins of their venomous relatives. In many parts of the world certain of these snakes are regularly regarded as valuable household pets, being clean and quiet and ridding their adopted homes of mice and rats.

And Snakes Make Lovely Pets!

Most snakes, indeed, soon become accustomed to human society and are tame and docile in captivity. The western bull-snake, which sometimes attains a length of nine feet and is the largest North American snake, is the favorite of the circus "snake charmers"; if it is fed enough eggs and poultry, it good-naturedly permits itself to be handled in the most careless fashion. The racers, which include the indigo snake, the blacksnake, the coach-whip, and the blue racer, are other large snakes which thrive in man's neighborhood, and, if they can be kept out of the chicken coop, perform considerable service in protecting crops from rodents. The coach-whip is perhaps the speediest and most active of all snakes, darting over the rough ground almost as if it had wings.

The rat snakes or *colubers*, including the corn snake, the pilot blacksnake, the fox snake, the chicken snake, are even more deserving of man's protection, for they regularly dwell in fields of growing grain and exterminate countless numbers of small harmful creatures.

But the most unjustly persecuted of all are the innumerable varieties of garter snakes—those graceful, delicately striped creatures, whose only offense is that, like many others of the snake tribe, they give off when first captured an evil odor. But even this habit disappears in a few days. As they feed chiefly on small frogs, toads, fish, and worms, they cannot be classed as useful; but if the snake "curse" can be forgotten, they lend bright color to the life of the countryside. They are very prolific, a single mother producing from 25 to 75 young in a single season.

Harmless Snakes that Pretend to Be Bad

There are many harmless snakes, however, that are to blame for their own misfortunes, for they do everything in their power to imitate their poisonous brothers. The familiar hog-nosed snake is a good example. The cobra and the rattlesnake together cannot present a picture of such villainous ferocity as this small creature, which cannot even be induced to bite. It hisses, and spreads out its neck, and darts its upturned nose so viciously in every direction that many people call it the "puff-adder" and are convinced of its venomous nature. Yet if you approach boldly, the hog-nose, instead of making good its bluff, will turn over on its back and pretend to be dead, remaining stiff and immovable no matter what treatment it receives. The only way you can make it betray its sham is by placing it on its stomach, when it will roll over again on its back like a flash.

Many of the water snakes (genus *Tropidonotus*), which frequent the borders of rivers, lakes, and swamps, court death by imitating the deadly moccasin. The bites of these harmless reptiles, being mistaken for moccasin or copperhead bites, and subsequently "cured" by popular or quack remedies, are responsible for a dangerous amount of misinformation about the treatment for snake venoms.

If there is a hero among American snakes, it is the king snake, which belongs to a genus (*Ophibolus*) ranging in size from 14 inches to 6 feet. The common king snake is a powerful creature from 4 to 5 feet long, marked with a striking pattern of yellow or white bands, arranged like a chain on a black background. This powerful reptile does not, as is sometimes said, actually hunt out poisonous snakes, but it gladly attacks any it may chance to meet. And whether it be a giant rattlesnake or a small copperhead, the result is always the same—the king snake wins. It coils itself quickly about its astonished adversary and tightens its grip with such strength that the victim is soon strangled, and, if not too large, it is eaten. But the king snake's courage is after all not so great, for it is immune to snake poison.

Snakes form the order *Ophidia* of the Reptile class. With the lizards, they are usually grouped in a subclass called *Sauria* (*see* Lizards; Reptiles). In several of the older families, like the boas, the skeleton shows traces of hind legs, which have been lost in the process of evolution. In this respect they show their close connection with the lizards, some of which, like the "glass snake," have no external limbs.

Although snakes seem to hear very well, they have no external ears, such hearing apparatus as they have being hidden beneath the skin. Their body is covered with even rows of scales. These scales are enlarged into fixed shields on their heads. In all but the true sea-snakes, the scales of the abdomen are modified into narrow "scutes," each one reaching clear across the belly and overlapping its rear neighbor like a shingle on a roof. This arrangement, as we have seen, takes the place of legs.

The majority of snakes lay eggs, which are whitish with a tough outer shell; but most of the vipers and all the sea-snakes bring forth living young, as do also our common garter snakes. As soon as the young are born or hatched, they are able to shift for themselves, the poisonous varieties having fully developed fangs and venom sacks.

In cold countries snakes hibernate during the winter. All the members of the order are able to go an extraordinary length of time without food, and many live to a great age.

SNIPE AND SANDPIPERS. Among the shore birds snipe are a favorite with hunters and they are much pursued. The snipe family, which includes also the sandpiper group, has about 100 species, ranging in size from the woodcock, 11 inches long (*see* Woodcock) to the "least" sandpiper, 6 inches long. The Wilson's snipe, or jacksnipe, is a delicate bird in both taste and appearance. It breeds from the northern borders of the United States north to the Arctic Sea, and migrates down across the United States during the autumn, when it is much hunted. Flashing suddenly from the grass it darts off with rapid flight, uttering its call, "*scaip, scaip, escape!*" During the winter jacksnipe are very plentiful about the marshes of Louisiana.

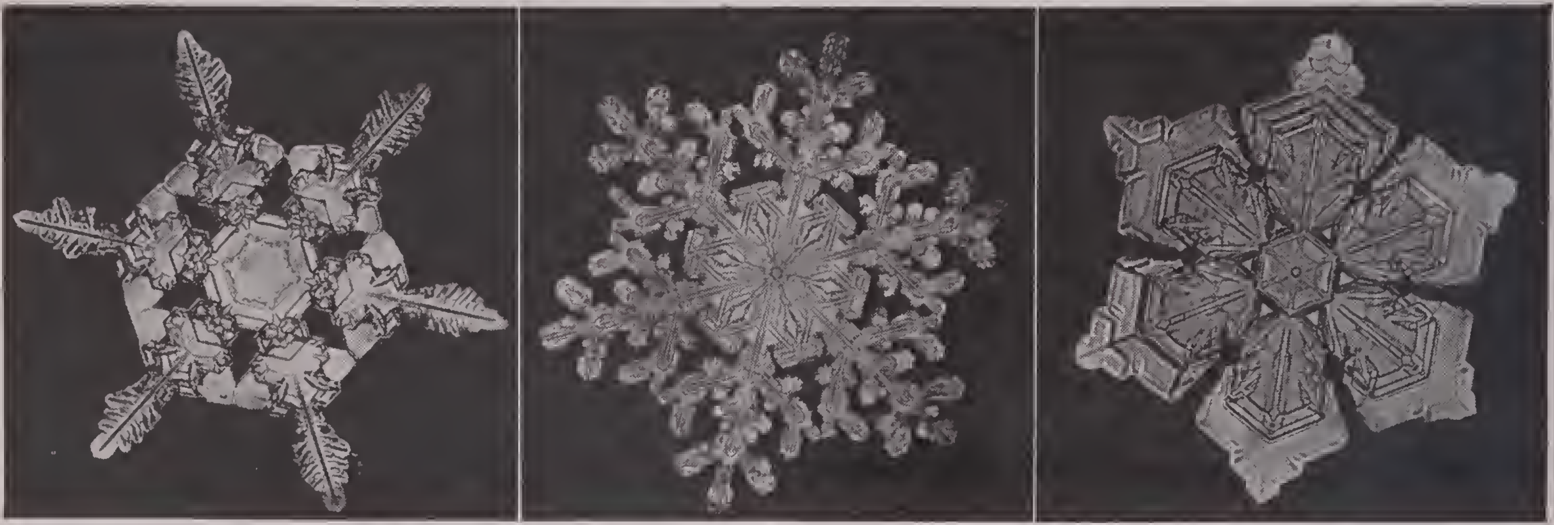
The red sandpiper, or "knot" (said to be named for King Cnut, or Canute, of England), is about the size of a robin, and in the summer has robin red-breast feathers. In the winter the breast feathers are grayish-white. After nesting in the far north, it migrates to the south, being found through Africa, India, Australia, and along the Atlantic coast of North America. The "least" sandpiper is the baby shore bird, and weighs no more than an English sparrow. With the long bill and legs of his family he is a curious little fellow. He nests north on the eastern and western coasts and winters in South America. During the mating season the male birds sing a little twittering song not unlike the song of a warbler.

The curlews, so called from their mournful cry *cur-lew*, also belong to the snipe family. Most species are of large size and they have exceedingly long slender downward-curving bills. The Eskimo curlew, or dough-bird, once found in great numbers in North America, is now, owing to the ruthlessness of hunters, almost extinct. The long-billed curlew and the Hudsonian curlew are now the most abundant species in America.

The snipes and sandpipers belong to the family *Scolopacidae;* scientific name of Wilson's snipe, *Gallinago delicata;* of red sandpiper, *Tringa canutus;* of least sandpiper, *Pisobia minutilla;* of long-billed curlew, *Numenius americanus;* of Hudsonian curlew, *Numenius hudsonicus.*

SNOW. In all latitudes snow forms out of the moisture in the upper air, but melts as it falls through the lower air, if this is warm. Thus from the Equator to latitude 30°, snow is almost unknown at sea-level; from latitude 30° to about 40°, it is an occasional winter visitant; from about 40° to 75°, it is generally present during a longer or shorter period in winter; in latitudes above 75°, snow falls on perennial snow, wherever there is land. At the Equator the snow line —the height above sea-level at which snow does not

TINY JEWELS OF ICE WHICH WINTER BRINGS



Snow is really ice, shaped into minute crystals. Often you will be able to catch single crystals in your hands and give them a quick study before they melt, but more often the flakes combine in groups before they reach the earth. Although they vary greatly in details, snow crystals all belong to the hexagonal system; that is, they all have six sides or angles.

melt—is about 17,000 feet above sea-level. From the Equator it descends to about 13,500 in latitude 30°, and 1,000 feet in latitude 70°. In regions of perpetual snow, the weight of one snowfall on another may, on steep mountain slopes, produce a snow slide or avalanche; on less steep slopes, the lower part of a snow field is changed to glacial ice (*see* Glacier).

One curious snow phenomenon is seen only in low latitudes where the tropical sun in some places sculptures the perennial snow of the mountains into fantastic colonnades so like processions of kneeling human figures that the South Americans call it the "snow of the penitents."

Where winters are severe, the presence of the snow blanket all winter protects the dormant vegetation beneath from fatal cold. In the spring the melting snow is equally useful in supplying needed moisture just in time for the awakening seeds and bulbs.

Snow consists of water crystals, though sometimes the snow flake is a shapeless woolly tuft or pellet composed of débris of the typical six-sided crystals. Probably no other substance crystallizes in such an infinite variety of beautiful forms as water. Some crystals are flat or tabular, some are columnar needles, and some are compound structures, and the variations of these three classes are endless. The most numerous and beautiful are the flat crystals, some of which branch out into flowered rosettes, while others within the plain six-sided outline contain beautiful inlaid designs formed by tiny air tubes within the crystal structure. The most curious are perhaps the "cuff-button" doublets composed of a large and a small tabular crystal connected by a columnar needle.

Not every snowstorm furnishes good specimens of snow crystals. The western, southwestern, and northwestern segments of great storms usually furnish the most perfect and beautiful crystals. You can imagine how difficult it is to photograph snow flakes before they melt, yet W. A. Bentley, of Vermont, the man who first accomplished the feat, has photographed more than 1,000 different forms.

Red, green, blue, and even black snow is occasionally seen in many parts of the world. The colors are due to the presence of innumerable tiny fungi, or to dust collected by the snow as it falls through the air.

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